



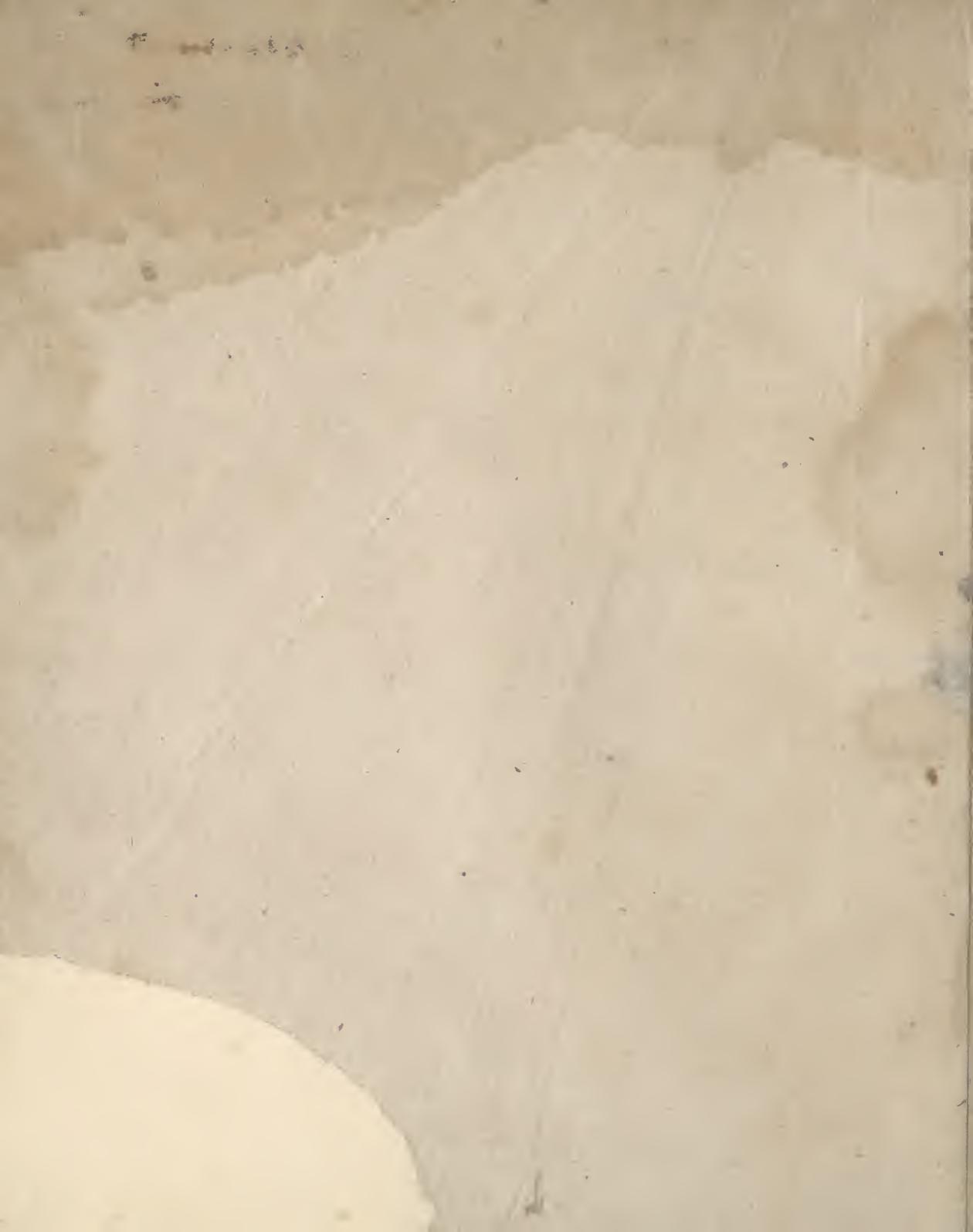
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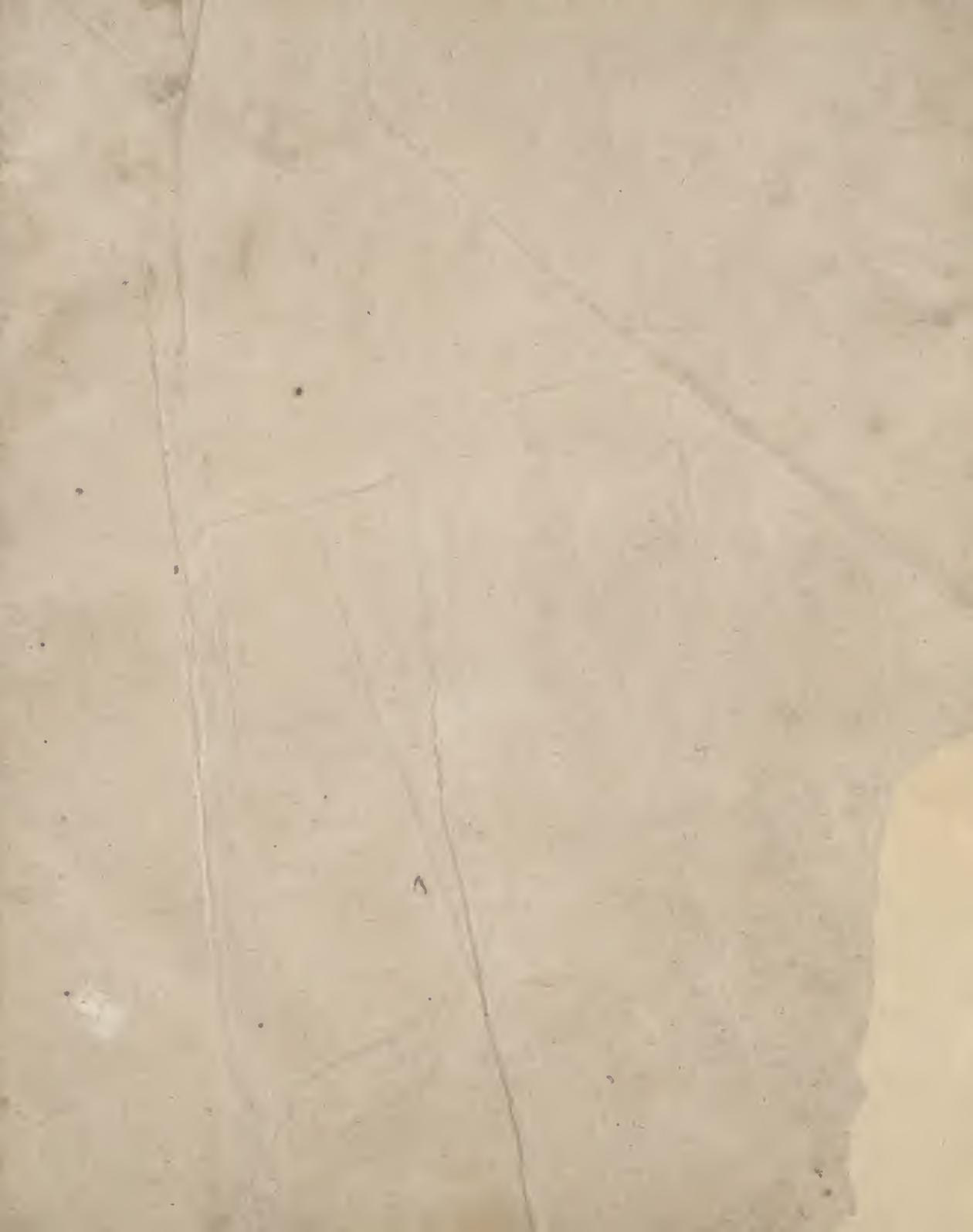
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**ENCYCLOPÆDIA BRITANNICA.**

*Geo. W. P. Esq. Boston*

VOLUME the THIRD.



# Encyclopædia Britannica;

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O R, A N E W

## D I C T I O N A R Y

O F

### A R T S and S C I E N C E S.

M A C

**M**ACAO, an island of China, in the province of Canton, fifty miles south of Canton.  
**MACAO**, in ornithology. See **PSITTACUS**.  
**MACCABEES**, two apocryphal books of scripture; so called from Judas Mattathias, surnamed Maccabeus. The first book of the Maccabees is an excellent history, and comes nearest to the style and manner of the sacred historians of any extant. It contains the history of forty years, from the reign of Antiochus Epiphanes to the death of Simon the high priest; that is, from the year of the world 3829 to the year 3869, 131 before Christ. The second book of the Maccabees begins with two epistles sent from the Jews of Jerusalem to the Jews of Egypt and Alexandria, to exhort them to observe the feast of the dedication of the new altar erected by Judas on his purifying the temple. After these epistles follows the preface of the author to his history, which is an abridgment of a larger work, composed by one Jason, a Jew of Cyrene, who wrote the history of Judas Maccabeus and his brethren, and the wars against Antiochus Epiphanes and Eupator his son. This second book does not, by any means, equal the accuracy and excellency of the first. It contains a history of about fifteen years, from the execution of Heliodorus's commission, who was sent by Seleucus to fetch away the treasures of the temple, to the victory obtained by Judas Maccabeus over Nicanor; that is, from the year of the world 3828, to the year 3843, 147 years before Christ.

**MACCLESFIELD**, a market-town of Cheshire, thirty-five miles east of Chester, from whence the noble family of Parker take the title of earl.

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M A C

**MACE**, the second coat or covering of the kernel of the nutmeg, is a thin and membranaceous substance, of an oleaginous nature and a yellowish colour; being met with in flakes of an inch and more in length, which are divided into a multitude of ramifications. It is of an extremely fragrant, aromatic and agreeable flavour, and of a pleasant, but acrid and oleaginous taste.

Mace is carminative, stomachic, and astringent; and possesses all the virtues of nutmeg, but is less astringent.

**MACEDONIA**, a province of European Turkey, bounded by Servia and Romania, on the north and east; by the gulphs of Salonichi, Contessa and Thessaly, on the south; and by Albania and Epirus, on the west.

**MACERATION**, is an infusion of, or soaking ingredients in water or any other fluid, in order either to soften them, or draw out their virtues.

**MACHIAN**, a small island of the Moluccas, which produces the best cloves: it is situated under the equator, in 125° E. long. and is subject to the Dutch.

**MACHINE**, in general, whatever hath force sufficient to raise or stop the motion of a heavy body. See **MCHANICS**.

**MACHINERY**, in epic and dramatic poetry, is when the poet introduces the use of machines, or brings some supernatural being upon the stage, in order to solve some difficulty, or to perform some exploit out of the reach of human power. See **COMPOSITION**.

**MACKERAN**, or **MACKAN**, the capital of a province in Persia of the same name; situated in E. long. 66°, and N. lat. 26°.

**MACKEREL**, in ichthyology. See **SCOMBER**.

A

**MACROCERCI**,

**MACROCERCI**, a name given to that class of animalcules, with tails longer than their bodies.

**MACROPYRENIUM**, in natural history, a genus of fossils, consisting of crustated septariae, with a long nucleus standing out at each end of the mass.

**MACROTELOSTYLA**, in natural history, a name of a genus of crystals, which are composed of two pyramids, joined to the end of a column; both the pyramids, as also the column, being hexangular, and the whole body consequently composed of eighteen planes.

**MACULÆ**, in astronomy, dark spots appearing on the luminous faces of the sun, moon, and even some of the planets. See **ASTRONOMY**.

These spots are most numerous and easily observed in the sun. It is not uncommon to see them in various forms, magnitudes, and numbers, moving over the sun's disk. They were first of all discovered by the lyncean astronomer Galileo, in the year 1610, soon after he had finished his new-invented telescope.

**MAD APPLE**. See **SOLANUM**.

**MADAGASCAR**, or *St Laurence*, an island of Africa, situated between  $43^{\circ}$  and  $51^{\circ}$  of east longitude, and between  $12^{\circ}$  and  $26^{\circ}$  south latitude; three hundred miles south-east of the continent of Africa. It is about a thousand miles in length from north to south, and generally between two and three hundred miles broad. The country is divided among a great number of petty sovereigns.

**MADDER**. See **RUBIA**.

**MADERAS**, some islands situated in the Atlantic ocean, three hundred miles west of Sallee, in Africa; in  $16^{\circ}$  W. long., and between  $32^{\circ}$  and  $33^{\circ}$  of N. lat.

The largest of them, called Madera, or rather Madera, by the Portuguese, is about an hundred and twenty miles in circumference; and produces incredible quantities of wine, which has the peculiar quality of keeping best in hot climates, where other wines turn sour.

**MADNESS**, a most dreadful kind of delirium, without a fever. See **MEDICINE**.

**MADRAS**, a town on the coast of Cormandel, inhabited by blacks, and situated just without the walls of the White town of Fort St George.

**MADRE DE POPA**, a town and convent of Terra Firma, in South America, situated on the river Grande, fifty miles east of Carthagenæ, almost as much resorted to by the pilgrims of America, as the chapel of Loretto is by the pilgrims of Europe: W. long.  $76^{\circ}$  N. lat.  $11^{\circ}$ .

**MADRID**, the capital of the province of New Castile, and of the whole kingdom of Spain: W. long.  $4^{\circ} 15'$ , and N. lat.  $4^{\circ} 30'$ .

**MADRIGAL**, is a short amorous poem, composed of a number of free and unequal verses, neither confined to the regularity of a sonnet, nor to the point of an epigram, but only consisting of some tender and delicate thought, expressed with a beautiful, noble, and elegant simplicity.

**MADRIGAL**, in geography, a city of the province of Popayan, in south America: W. long.  $75^{\circ} 30'$ , and N. lat.  $30'$ .

**MADURA**, the capital of the province of the same name in the hither India: E. long.  $77^{\circ}$ , and N. lat.  $10^{\circ}$ .

**MÆMACTERION**, the fourth month of the Athenian year, consisting of only twenty-nine days, and answering to the latter part of September and the beginning of October.

**MÆNA**, in ichthyology. See **SPARUS**.

**MAES**, a river which arises in Burgundy, and runs through Lorrain and Champaign into the Netherlands, and at last, after passing by many considerable towns, discharges itself into the German sea, a little below the Briel.

**MAESTRICHT**, a town in the province of Brabant, situated on the river Maes, thirteen miles north of Liege: E. long.  $5^{\circ} 40'$ , and N. lat.  $50^{\circ} 55'$ .

**MAGADOXA**, the capital of the territory of the same name, at the mouth of the river Magadoxa, on the coast of Anian, in Africa: E. lon.  $41^{\circ}$ , and N. lat.  $2^{\circ}$ .

**MAGAZINE**, a place in which stores are kept, of arms, ammunition, provisions, &c. Every fortified town ought to be furnished with a large magazine, which should contain stores of all kinds, sufficient to enable the garrison and inhabitants to hold out a long siege, and in which smiths, carpenters, wheelwrights, &c. may be employed, in making every thing belonging to the artillery, as carriages, waggons, &c.

**MAGDALEN**, or *Nuns of St Magdalen*, an order of religious in the Romish church, dedicated to St Mary Magdalen, and sometimes called Magdalenettes. These chiefly consist of courtizans, who, quitting their profession, devote the rest of their lives to repentance and mortification.

**MAGDEBURG**, the capital of the duchy of the same name, situated on the river Elbe, seventy miles west of Berlin: E. long.  $12^{\circ}$ , and N. lat.  $52^{\circ} 15'$ .

**MAGDELENA**, a large river of South America, which, rising near the equator, runs north through Terra Firma, and, uniting its waters with the river Cance, obtains the name of the river Grande, and falls into the north sea, below the town of Madre de Popa.

**MAGELLAN STRAIGHTS**, or rather *Straits of Magellan*. These straits are about three hundred miles in length from the Atlantic to the Pacific ocean, but of a very unequal breadth; and were at first discovered and passed by Ferdinand Magellan, from whom they had their name: they are situated between the island Terra del Fuego and the most southern part of the continent of America, between  $76^{\circ}$  and  $84^{\circ}$  of W. long. and between  $52^{\circ}$  and  $54^{\circ}$  of south lat.

**MAGI**, or **MAGIANS**, an ancient religious sect in Persia and other eastern countries, who maintained, that there were two principles, the one the cause of all good, the other the cause of all evil; and, abominating the adoration of images, worshipped God only by fire, which they looked upon as the brightest and most glorious symbol of Ormazdes, or the good God; as darkness is the truest symbol of Arimanius, or the evil god. This religion was reformed by Zoroaster, who maintained that there was one supreme independent being; and under him two principles or angels, one the angel

of goodness and light, and the other of evil and darkness: that there is a perpetual struggle between them, which shall last to the end of the world; that then the angel of darkness and his disciples shall go into a world of their own, where they shall be punished in everlasting darkness; and the angel of light and his disciples shall also go into a world of their own, where they shall be rewarded in everlasting light.

The priests of the magi were the most skilful mathematicians and philosophers of the ages in which they lived, inasmuch that a learned man and a magian became equivalent terms. The vulgar looked on their knowledge as more than natural, and imagined them inspired by some supernatural power; and hence those who practised wicked and mischievous arts, taking upon themselves the name of magians, drew on it that ill signification which the word magician now bears among us.

This sect still subsists in Persia, under the denomination of gours, where they watch the sacred fire with the greatest care, and never suffer it to be extinguished. **MAGIC**, originally signified only the knowledge of the more sublime parts of philosophy; but as the magi likewise professed astrology, divination and sorcery, the term magi became odious, being used to signify an unlawful diabolical kind of science, acquired by the assistance of the devil and departed souls.

**MAGIC LANTERN**, in optics. See **OPTICS**.

**MAGISTRY**, in chemistry, a very fine powder made by solution and precipitation.

**MAGISTRY of Bismuth**. See **CHEMISTRY**, p. 90.

**MAGISTRATE**, any public officer to whom the executive power of the law is committed, either wholly or in part.

**MAGNA ASSISA ELIGENDA**, is a writ anciently directed to the sheriff for summoning four lawful knights before the justices of assize, in order to chuse twelve knights of the neighbourhood, &c. to pass upon the great assize between such a person plaintiff, and such a one defendant.

**MAGNA CHARTA**, the great charter of the liberties of Britain, and the basis of our laws and privileges.

This charter may be said to derive its origin from king Edward the Confessor, who granted several privileges to the church and state by charter: these liberties and privileges were also granted and confirmed by king Henry I. by a celebrated great charter now lost; but which was confirmed or re-enacted by king Henry II. and king John. Henry III. the successor of this last prince, after having caused twelve men to make inquiry into the liberties of England in the reign of Henry I. granted a new charter, which was the same as the present magna charta: this he several times confirmed, and as often broke; till, in thirty-seventh year of his reign, he went to Westminster-hall, and there, in the presence of the nobility and bishops, who held lighted candles in their hands, magna charta was read, the king all the while holding his hand to his breast, and at last solemnly swearing faithfully and inviolably to observe all the things therein contained,

&c. then the bishops extinguishing the candles, and throwing them on the ground, they all cried out, "Thus let him be extinguished, and sink in hell, who violates this charter." It is observed, that notwithstanding the solemnity of this confirmation, king Henry, the very next year, again invaded the rights of his people, till the barons entered into a war against him, when, after various success, he confirmed this charter; and the charter of the forest, in the fifty second year of his reign. This excellent charter, so equitable and beneficial to the subject, is the ancientest written law in the kingdom: by the 25 Edw. I. it is ordained that it shall be taken as the common law; and by the 43 Edward III. all statutes made against it are declared to be void.

**MAGNESIA**. See **CHEMISTRY**, p. 119.

**MAGNET**, or **LOADSTONE**, in natural history, a very rich iron ore, found in large detached masses, of a dusky iron-grey, often tinged with brownish or reddish, and when broken appearing something like the common emery, but less sparkling. It is very heavy, considerably hard, of a perfectly irregular and uneven surface, and of a firm structure, but usually with some porous irregularities within. It is found in Britain, and all other places where there are iron mines. See **MECHANICS**.

**MAGNIFYING**, the making of objects appear larger than they would otherwise do; whence convex lenses, which have the power of doing this, are called magnifying glasses. See **OPTICS**.

**MAGNITUDE**, whatever is made up of parts locally extended, or that hath several dimensions; as a line, surface, solid, &c.

**MAGNOLIA**, in botany, a genus of the polyandria polygynia class: The calix consists of three leaves, and the corolla of nine petals; the capsules are imbricated, and have two valves; and the seed is a pendulous berry. There are four species, all natives of America.

**MAGPY**, in ornithology. See **CORVUS**.

**MAHOMETANS**, those who believe in the religion and divine mission of Mahomet, or Mohammed.

It will not be improper here to give a general account of this extraordinary person, and the religion which he had the address to propagate over most of the eastern nations.

Mohammed was born in the reign of Anushirwan the Just, emperor of Persia, about the end of the 6th century of the Christian æra. He came into the world under some disadvantages. His father Abd'allah was a younger son of Abd'almotaleb, and, dying very young, and in his father's life time, left his widow and infant son in very mean circumstances, his whole substance consisting but of five camels and one Ethiopian slave. Abd'almotaleb was therefore obliged to take care of his grandchild Mohammed, which he not only did during his life, but at his death enjoined his eldest son Abu Taleb, who was brother to Abd'allah by the same mother, to provide for him for the future; which he very affectionately did, and instructed him in the business of a merchant which he followed; and to that end he took him into Syria when he was but thirteen,

and

and afterwards recommended him to Khadijah, a noble and rich widow, for her factor; in whose service he behaved himself so well, that by making him her husband she soon raised him to an equality with the richest in Mecca.

After he began by this advantageous match to live at his ease, it was that he formed the scheme of establishing a new religion, or, as he expressed it, of replanting the only true and ancient one, professed by Adam, Noah, Abraham, Moses, Jesus, and all the prophets, by destroying the gross idolatry into which the generality of his countrymen had fallen, and weeding out the corruptions and superstitions which the latter Jews and Christians had, as he thought, introduced into their religion, and reducing it to its original purity, which consisted chiefly in the worship of one only God.

Before he made any attempt abroad, he rightly judged that it was necessary for him to begin with the conversion of his own household. Having therefore retired with his family, as he had done several times before, to a cave in mount *Hara*, he there opened the secret of his mission to his wife Khadijah; and acquainted her that the angel Gabriel had just before appeared to him, and told him that he was appointed the apostle of God: he also repeated to her a passage which he pretended had been revealed to him by the ministry of the angel, with those other circumstances of this first appearance, which are related by the Mohammedan writers. Khadijah received the news with great joy; swearing by him in whose hands her soul was, that she trusted he would be the prophet of his nation; and immediately communicated what she had heard to her cousin Warakah Ebn Nawfal, who, being a Christian, could write in the Hebrew character, and was tolerably well versed in the scriptures; and he as readily came into her opinion, assuring her that the same angel who had formerly appeared unto Moses was now sent to Mohammed. The first overture the prophet made in the month of Ramadan, in the fortieth year of his age, which is therefore usually called the year of his mission.

Encouraged by so good a beginning, he resolved to proceed, and try for some time what he could do by private persuasion, not daring to hazard the whole affair by exposing it too suddenly to the public. He soon made proselytes of those under his own roof, viz. his wife Khadijah, his servant Zeid Ebn Haretha (to whom he gave his freedom on that occasion, which afterwards became a rule to his followers) and his cousin and pupil Ali, the son of Abu Taleb, though then very young: but this last, making no account of the other two, used to style himself the *first of believers*. The next person Mohammed applied to was Abd'allah Ebn Abi Kohafa, surnamed Abu Becr, a man of great authority among the Koreish, and one whose interest he well knew would be of great service to him; as it soon appeared: for Abu Becr, being gained over, prevailed also on Othman Ebn Affan, Abd' alrahman Ebn Awf, Saad Ebn Abi Wakkas, al Zobeir Ebn al Awam, and Telha Ebn Obeid'allah, all principal men of Mecca, to follow his example. These men were the six chief companions, who, with a few more, were converted in the space of three years; at the end of which, Mohammed having, as he hoped, a sufficient in-

terest to support him, made his mission no longer a secret, but gave out that God had commanded him to admonish his near relations, and, in order to do it with more convenience and prospect of success, he directed Ali to prepare an entertainment, and invite the sons and descendants of Abd'almotaleb, intending then to open his mind to them: this was done, and about forty of them came; but Abu Laheb, one of his uncles, making the company break up before Mohammed had an opportunity of speaking, obliged him to give them a second invitation the next day; and when they were come, he made them the following speech: "I know no man in all Arabia who can offer his kindred a more excellent thing than I now do you: I offer you happiness both in this life, and in that which is to come; God Almighty hath commanded me to call you unto him; Who therefore among you will be assistant to me herein, and become my brother and my vicegerent?" All of them hesitating, and declining the matter, Ali at length rose up, and declared that he would be his assistant; and vehemently threatened those who should oppose him. Mohammed upon this embraced Ali with great demonstrations of affection, and desired all who were present to hearken to and obey him, as his deputy; at which the company broke out into a great laughter, telling Abu Taleb that he must now pay obedience to his son.

This repulse however was so far from discouraging Mohammed, that he began to preach in public to the people, who heard him with some patience, till he came to upbraid them with the idolatry, obstinacy, and perverseness of themselves and their fathers; which so highly provoked them, that they declared themselves his enemies, and would soon have procured his ruin, had he not been protected by Abu Taleb. The chief of the Koreish warmly solicited this person to desert his nephew, making frequent remonstrances against the innovations he was attempting; which proving ineffectual, they at length threatened him with an open rupture, if he did not prevail on Mohammed to desist. At this Abu Taleb was so far moved, that he earnestly dissuaded his nephew from pursuing the affair any farther, representing the great danger he and his friends must otherwise run. But Mohammed was not to be intimidated, telling his uncle plainly, *that if they set the sun against him on his right hand, and the moon on his left, he would not leave his enterprise*: and Abu Taleb, seeing him so firmly resolved to proceed, used no further arguments, but promised to stand by him against all his enemies.

The Koreish, finding they could prevail neither by fair words nor menaces, tried what they could do by force and ill treatment; using Mohammed's followers so very injuriously, that it was not safe for them to continue at Mecca any longer; whereupon Mohammed gave leave to such of them as had not friends to protect them to seek for refuge elsewhere. And accordingly, in the fifth year of the prophet's mission, sixteen of them, four of whom were women, fled into Ethiopia; and among them Othman Ebn Affan and his wife Rakhiah, Mohammed's daughter. This was the first flight; but afterwards several others followed them, retiring one after another, to the number of eighty-three men and eighteen women,

besides

besides children. These refugees were kindly received by the Najashi, or king of Ethiopia, who refused to deliver them up to those whom the Koreish sent to demand them, and, as the Arab writers unanimously attest, even professed the Mohammedan religion.

In the sixth year of his mission Mohammed had the pleasure of seeing his party strengthened by the conversion of his uncle Hamza, a man of great valour and merit, and of Omar Ebn al Khattab, a person highly esteemed, and once a violent opposer of the prophet. As persecution generally advances rather than obstructs the spreading of a religion, Islamism made so great a progress among the Arab tribes, that the Koreish, to suppress it effectually, if possible, in the seventh year of Mohammed's mission, made a solemn league or covenant against the Hashemites and the family of Abd'almoralleb, engaging themselves to contract no marriages with any of them, and to have no communication with them; and, to give it the greater sanction, reduced it into writing, and laid it up in the Caaba. Upon this the tribe became divided into two factions; and the family of Hashem all repaired to Abu Taleb, as their head; except only Abd'al Uzza, surnamed Abu Laheb, who, out of his inveterate hatred to his nephew and his doctrine, went over to the opposite party, whose chief was Abu Sofian Ebn Harb, of the family of Ommeya.

The families continued thus at variance for three years; but, in the tenth year of his mission, Mohammed told his uncle Abu Taleb, that God had manifestly shewed his disapprobation of the league which the Koreish had made against them, by sending a worm to eat out every word of the instrument, except the name of God. Of this accident Mohammed had probably some private notice; for Abu Taleb went immediately to the Koreish and acquainted them with it; offering, if it proved false, to deliver his nephew up to them; but, in case it were true, he insisted that they ought to lay aside their animosity, and annul the league they had made against the Hashemites. To this they acquiesced, and, going to inspect the writing, to their great astonishment found it to be as Abu Taleb had said; and the league was thereupon declared void.

In the same year Abu Taleb died, at the age of above fourscore; and it is the general opinion that he died an infidel; though others say, that when he was at the point of death he embraced Mohammedism, and produce some passages out of his poetical compositions to confirm their assertion. About a month, or, as some write, three days after the death of this great benefactor and patron, Mohammed had the additional mortification to lose his wife Khadijah, who had so generously made his fortune. For which reason this year is called the *year of mourning*.

On the death of these two persons the Koreish began to be more troublesome than ever to their prophet, and especially some who had formerly been his intimate friends; insomuch that he found himself obliged to seek for shelter elsewhere, and first pitched upon Tayef, about sixty miles east from Mecca, for the place for his retreat. Thither therefore he went, accompanied by his servant Zied, and applied himself to two of the chief of the tribe of Thakif who were the inhabitants of that place; but

they received them very coldly. However, he staid there a month; and some of the more considerate and better sort of men treated him with a little respect: but the slaves and inferior people at length rose against him, and, bringing him to the wall of the city, obliged him to depart, and return to Mecca; where he put himself under the protection of al Motaam Ebn Adi.

This repulse greatly discouraged his followers: however, Mohammed was not wanting to himself, but boldly continued to preach to the public assemblies at the pilgrimage, and gained several proselytes, and among them six of the inhabitants of Yathreb of the Jewish tribe of Khazraj, who, on their return home, failed not to speak much in commendation of their new religion, and exhorted their fellow-citizens to embrace the same.

In the twelfth year of his mission it was that Mohammed gave out that he had made his night journey from Mecca to Jerusalem, and thence to heaven, so much spoken of by all that write of him. Dr Prideaux thinks he invented it, either to answer the expectations of those who demanded some miracle as a proof of his mission; or else, by pretending to have conversed with God, to establish the authority of whatever he should think fit to leave behind by way of oral tradition, and make his sayings to serve the same purpose as the oral law of the Jews. But it does not appear that Mohammed himself ever expected so great a regard should be paid to his sayings, as his followers have since done; and seeing he all along disclaimed any power of performing miracles, it seems rather to have been a fetch of policy to raise his reputation, by pretending to have actually conversed with God in heaven, as Moses had heretofore done in the mount, and to have received several institutions immediately from him, whereas before he contented himself with persuading them that he had all by the ministry of Gabriel.

However, this story seemed so absurd and incredible, that several of his followers left him upon it; and had probably ruined the whole design, had not Abu Becr vouched for his veracity, and declared that, if Mohammed affirmed it to be true, he verily believed the whole. Which happy incident not only retrieved the prophet's credit, but increased it to such a degree, that he was secure of being able to make his disciples swallow whatever he pleased to impose on them for the future. And this fiction, notwithstanding its extravagance, was one of the most artful contrivances Mohammed ever put in practice, and what chiefly contributed to the raising of his reputation to that great height to which it afterwards arrived.

In this year, called by the Mohammedans the *accepted year*, twelve men of Yathreb or Medina, of whom ten were of the tribe of Khazraj; and the other two of that of Aws, came to Mecca, and took an oath of fidelity to Mohammed at al Akaba, a hill on the north of that city. This oath was called the *womens oath*; not that any women were present at this time, but because a man was not thereby obliged to take up arms in defence of Mohammed or his religion; it being the same oath that was afterwards exacted of the women, the form of which we have in the Koran, and is to this effect; *viz.* That they should renounce all idolatry; and they should not steal, nor commit fornication, nor kill their children (as the

Pagan Arabs used to do when they apprehended they should not be able to maintain them,) nor forge calumnies; and that they should obey the prophet in all things that were reasonable. When they had solemnly engaged to all this, Mohammed sent one of his disciples, named Mafab Ebn Omair, home with them, to instruct them more fully in the grounds and ceremonies of his new religion.

Mafab being arrived at Medina, by the assistance of those who had been formerly converted, gained several profelytes, particularly Ofsaid Ebn Hodeira, a chief man of the city, and Saad Ebn Moadh, prince of the tribe of Aws; Mohammedism spreading so fast, that there was scarce a house wherein there were not some who had embraced it.

The next year, being the thirteenth of Mohammed's mission, Mafab returned to Mecca, accompanied by seventy-three men and two women of Medina who had professed Islamism, besides some others who were as yet unbelievers. On their arrival, they immediately sent to Mohammed, and offered him their assistance, of which he was now in great need; for his adversaries were by this time grown so powerful in Mecca, that he could not stay there much longer without imminent danger. Wherefore he accepted their proposal, and met them one night, by appointment, at al Akaba above-mentioned, attended by his uncle al Abbas, who, though he was not then a believer, wished his nephew well, and made a speech to those of Medina, wherein he told them, that as Mohammed was obliged to quit his native city, and seek an asylum elsewhere, and they had offered him their protection, they would do well not to deceive him; that if they were not firmly resolved to defend, and not betray him, they had better declare their minds, and let him provide for his safety in some other manner. Upon their protesting their sincerity, Mohammed swore to be faithful to them, on condition that they should protect him against all insults, as heartily as they would their own wives and families. They then asked him what recompence they were to expect if they should happen to be killed in his quarrel; he answered, paradise. Whereupon they pledged their faith to him, and so returned home; after Mohammed had chosen twelve out of their number, who were to have the same authority among them as the twelve apostles of Christ had among his disciples.

Hitherto Mohammed had propagated his religion by fair means, so that the whole success of his enterprize, before his flight to Medina, must be attributed to persuasion only, and not to compulsion. For before this second oath of fealty or inauguration at al Akaba, he had no permission to use any force at all; and in several places of the Koran, which he pretended were revealed during his stay at Mecca, he declares his business was only to preach and admonish; that he had no authority to compel any person to embrace his religion; and that, whether people believe or not, was none of his concern, but belonged solely unto God. And he was so far from allowing his followers to use force, that he exhorted them to bear patiently those injuries which were offered them on account of their faith; and, when persecuted himself, chose rather to quit the place of his birth, and retire to

Medina, than to make any resistance. But this great passiveness and moderation seem entirely owing to his want of power, and the great superiority of his opposers for the first twelve years of his mission; for no sooner was he enabled, by the assistance of those of Medina, to make head against his enemies, than he gave out, that God had allowed him and his followers to defend themselves against the infidels; and at length, as his forces increased, he pretended to have the divine leave even to attack them; and to destroy idolatry, and set up the true faith by the sword; finding, by experience, that his designs would otherwise proceed very slowly, if they were not utterly overthrown; and knowing, on the other hand, that innovators, when they depend solely on their own strength, and can compel, seldom run any risque; from whence, says Machiavel, it follows, that all the armed prophets have succeeded, and the unarmed ones have failed. Moses, Cyrus, Theseus, and Romulus, would not have been able to establish the observance of their institutions for any length of time, had they not been armed. The first passage of the Koran which gave Mohammed the permission of defending himself by arms, is said to have been that in the twenty-second chapter; after which a great number to the same purpose were revealed.

That Mohammed had a right to take up arms for his own defence against his unjust persecutors, may, perhaps, be allowed; but whether he ought afterwards to have made use of that means for the establishing of his religion, is not so easy to determine. How far the secular power may or ought to interpose in affairs of this nature, mankind are not agreed. The method of converting by the sword gives no very favourable idea of the faith which is so propagated, and is disallowed by every body in those of another religion, though the same persons are willing to admit of it for the advancement of their own; supposing that, though a false religion ought not to be established by authority, yet a true one may; and accordingly force is almost as constantly employed in these cases by those who have the power in their hands, as it is constantly complained of by those who suffer the violence. It is certainly one of the most convincing proofs that Mohammedism was no other than a human invention, that it owed its progress and establishment almost entirely to the sword; and it is one of the strongest demonstrations of the divine original of Christianity, that it prevailed against all the force and powers of the world by the mere dint of its own truth, after having stood the assaults of all manner of persecutions, as well as other oppositions, for three hundred years together, and at length made the Roman emperors themselves submit thereto; after which time, indeed, this proof seems to fail, Christianity being then established, and Paganism abolished, by public authority, which has had great influence in the propagation of the one and destruction of the other ever since. But to return:

Mohammed, having provided for the security of his companions as well as his own, by the league offensive and defensive which he had now concluded with those of Medina, directed them to repair thither, which they accordingly did; but himself with Abu Becr and Ali staid behind, having not yet received the divine permission, as

he pretended, to leave Mecca, The Koreish, fearing the consequence of this new alliance, began to think it absolutely necessary to prevent Mohammed's escape to Medina; and having held a council thereon, after several milder expedients had been rejected, they came to a resolution that he should be killed; and agreed that a man should be chosen out of every tribe for the execution of this design; and that each man should have a blow at him with his sword, that the guilt of his blood might fall equally on all the tribes, to whose united power the Hashemites were much inferior, and therefore durst not attempt to revenge their kinsman's death.

This conspiracy was scarce formed, when, by some means or other, it came to Mohammed's knowledge; and he gave out that it was revealed to him by the angel Gabriel, who had now ordered him to retire to Medina. Whereupon, to amuse his enemies, he directed Ali to lie down in his place, and wrap himself up in his green cloak, which he did; and Mohammed escaped miraculously, as they pretend, to Abu Becr's house, unperceived by the conspirators, who had already assembled at the prophet's door. They, in the mean time, looking through the crevice, and seeing Ali, whom they took to be Mohammed himself, asleep, continued watching there till morning, when Ali awoke, and they found themselves deceived.

From Abu Becr's house Mohammed and he went to a cave in mount Thur, to the fourth-east of Mecca, accompanied only by Amer Ebn Foheirah, Abu Becr's servant, and Abd'allah Ebn Oreitah, an idolater whom they had hired for a guide. In this cave they lay hid three days, to avoid the search of their enemies; which they very narrowly escaped, and not without the assistance of more miracles than one: for some say that the Koreish were struck with blindness, so that they could not find the cave; others, that after Mohammed and his companions were got in, two pigeons laid their eggs at the entrance, and a spider covered the mouth of the cave with her web, which made them look no farther. Abu Becr, seeing the prophet in such imminent danger, became very sorrowful; whereupon Mohammed comforted him with these words, recorded in the Koran, *Be not grieved, for God is with us.* Their enemies being retired, they left the cave, and set out for Medina, by a by road; and having fortunately, or, as the Mohammedans tell us, miraculously escaped some who were sent to pursue them, arrived safely at that city; whither Ali followed them in three days, after he had settled some affairs at Mecca.

The first thing Mohammed did after his arrival at Medina, was to build a temple for his religious worship, and a house for himself, which he did on a parcel of ground which had before served to put camels in, or, as others tell us, for a burying-ground and belonged to Sahal and Soheil the sons of Amru, who were orphans. This action Dr Prideaux exclaims against, representing it as a flagrant instance of injustice; for that, says he, he violently dispossessed these poor orphans, the sons of an inferior artificer (whom the author he quote calls a carpenter) of this ground, and so founded the first fabric of his worship with the like wickedness as he did his religion. But, to say nothing of the improbability that Mohammed should act in so impolitic a manner at his first coming, the Moham-

edan writers set this affair in a quite different light: one tells us that he treated with the lads about the price of the ground, but they desired he would accept it as a present: however, as historians of good credit assure us, he actually bought it; and the money was paid by Abu Becr. Besides, had Mohammed accepted it as a present, the orphans were in circumstances sufficient to have afforded it; for they were of a very good family, of the tribe of Najjar, one of the most illustrious among the Arabs, and not the sons of a carpenter, as Dr Prideaux's author writes, who took the word Najjar, which signifies a carpenter, for an appellative, whereas it is a proper name.

Mohammed, being securely settled at Medina, and able not only to defend himself against the insults of his enemies, but to attack them, began to send out small parties to make reprisals on the Koreish; the first party consisting of no more than nine men, who intercepted and plundered a caravan belonging to that tribe, and in the action took two prisoners. But what established his affairs very much, and was the foundation on which he built all his succeeding greatness, was the gaining of the battle of Bedr, which was fought in the second year of the Hejra, and is so famous in the Mohammedan history. Some reckon no less than twenty-seven expeditions wherein Mohammed was personally present, in nine of which he gave battle, besides several other expeditions in which he was not present. His forces he maintained partly by the contributions of his followers for this purpose, which he called by the name of zacaat or alms, and the paying of which he very artfully made one main article of his religion; and partly by ordering a fifth part of the plunder to be brought into the public treasury for that purpose, in which matter he likewise pretended to act by the divine direction.

In a few years by the success of his arms (notwithstanding he sometimes came off by the worst) he considerably raised his credit and power. In the sixth year of the Hejra he set out with 1400 men to visit the temple of Mecca, not with any intent of committing hostilities, but in a peaceable manner. However, when he came to al Hodeibiya, which is situate partly within and partly without the sacred territory, the Koreish sent to let him know that they would not permit him to enter Mecca, unless he forced his way; whereupon he called his troops about him and they all took a solemn oath of fealty or homage to him, and he resolved to attack the city; but those of Mecca sending Arwa Ebn Masud, prince of the tribe of Thakif, as their ambassador, to desire peace, a truce was concluded between them for ten years, by which any person was allowed to enter into league either with Mohammed, or with the Koreish, as he thought fit.

It may not be improper to shew the inconceivable veneration and respect the Mohammedans by this time had for their prophet, to mention the account which the above-mentioned ambassador gave the Koreish, at his return of their behaviour. He said he had been at the courts both of the Roman emperor and of the king of Persia, and never saw any prince so highly respected by his subjects as Mohammed was by his companions; for, whenever he made the ablution, in order to say his prayers, they ran and caught the water that he had used; and, whenever he spit, they immediately licked it up, and gather-

ed up every hair that fell from him with great superstition.

In the seventh year of the Hejra, Mohammed began to think of propagating his religion beyond the bounds of Arabia, and sent messengers to the neighbouring princes, with letters to invite them to Mohammedism. Nor was this project without some success. Khofru Parviz, then king of Persia, received his letter with great disdain, and tore it in a passion, sending away the messenger very abruptly; which when Mohammed heard, he said, *God shall tear his kingdom*. And soon after a messenger came to Mohammed from Badhan king of Yaman, who was a dependent on the Persians, to acquaint him that he had received orders to send him to Khofru. Mohammed put off his answer till the next morning, and then told the messenger it had been revealed to him that night that Khofru was slain by his son Shiruyeh; adding, that he was well assured his new religion and empire should rise to as great a height as that of Khofru; and therefore bid him advise his master to embrace Mohammedism. The messenger being returned, Badhan in a few days received a letter from Shiruyeh, informing him of his father's death, and ordering him to give the prophet no further disturbance. Whereupon Badhan and the Persians with him turned Mohammedans.

The emperor Heraclius, as the Arabian historians assure us, received Mohammed's letter with great respect, laying it on his pillow, and dismissed the bearer honourably. And some pretend that he would have professed this new faith, had he not been afraid of losing his crown.

Mohammed wrote to the same effect to the king of Ethiopia, though he had been converted before, according to the Arab writers; and to Mokawkas, governor of Egypt, who gave the messenger a very favourable reception, and sent several valuable presents to Mohammed, and among the rest two girls, one of which, named Mary, became a great favourite with him. He also sent letters of the like purport to several Arab princes; particularly one to al Hareth Ebn Abi Shamer king of Ghassan, who returning for answer that he would go to Mohammed himself, the prophet said, *May his kingdom perish*; another to Hawdha Ebn Ali, king of Yamama, who was a Christian, and, having some time before professed Islamism, had lately returned to his former faith; this prince sent back a very rough answer, upon which Mohammed cursing him, he died soon after; and a third to al Mondar Ebn Sawa, king of Bahrein, who embraced Mohammedism, and all the Arabs of that country followed his example.

The eighth year of the Hejra was a very fortunate year to Mohammed. In the beginning of it, Khaled Ebn al Walid and Amru Ebn al As, both excellent soldiers, the first of whom afterwards conquered Syria and other countries, and the latter Egypt, became proselytes of Mohammedism. And soon after the prophet sent 3000 men against the Grecian forces, to revenge the death of one of his ambassadors, who being sent to the governor of Bosra on the same errand as those who went to the above-mentioned princes, were slain by an Arab, of the tribe of Ghassan, at Muta, a town in the territory of Balka in Syria, about three days journey eastward from Jerusalem, near which town they encountered. The Grecians being vastly superior in number (for, including the auxiliary

Arabs, they had an army of 100,000 men) the Mohammedans were repulled in the first attack, and lost successively three of their generals, viz. Zeid Ebn Haretha Mohammed's freedman, Jaafar the son of Abu Taleb, and Abdallah Ebn Rawaha; but Khaled Ebn al Walid, succeeding to the command, overthrew the Greeks with a great slaughter, and brought away abundance of rich spoil; on occasion of which action Mohammed gave him the honourable title of *Seif min foyuf Allah, one of the swords of God*.

In this year also Mohammed took the city of Mecca, the inhabitants whereof had broken the truce concluded on two years before. For the tribe of Becr, who were confederates with the Koreish, attacking those of Khozaah, who were allies of Mohammed, killed several of them, being supported in the action by a party of the Koreish themselves. The consequence of this violation was soon apprehended; and Abu Sofian himself made a journey to Medina on purpose to heal the breach and renew the truce; but in vain: for Mohammed, glad of this opportunity, refused to see him: whereupon he applied to Abu Becr and Ali; but they giving him no answer, he was obliged to return to Mecca as he came.

Mohammed immediately gave orders for preparations to be made, that he might surprize the Meccans while they were unprovided to receive him: in a little time he began his march thither, and by that time he came near the city his forces were increased to 10,000 men. Those of Mecca, being not in a condition to defend themselves against so formidable an army, surrendered at discretion; and Abu Sofian saved his life by turning Mohammedan. About twenty-eight of the idolaters were killed by a party under the command of Khaled; but this happened contrary to Mohammed's orders, who, when he entered the town, pardoned all the Koreish, on their submission, except only six men and four women, who were more obnoxious than ordinary (some of them having apostatised) and were solemnly proscribed by the prophet himself; but of these no more than threemen and one woman were put to death, the rest obtaining pardon on their embracing Mohammedism, and one of the women making her escape.

The remainder of this year Mohammed employed in destroying the idols in and round Mecca, sending several of his generals on expeditions for that purpose, and to invite the Arabs to Islamism; wherein it is no wonder if they now met with success.

The next year, being the ninth of the Hejra, the Mohammedans call *the year of embassies*: for the Arabs had been hitherto expecting the issue of the war between Mohammed and the Koreish; but, so soon as that tribe, the principal of the whole nation, and the genuine descendants of Ishmael, whose prerogatives none offered to dispute, had submitted, they were satisfied that it was not in their power to oppose Mohammed, and therefore began to come in to him in great numbers, and to send embassies to make their submissions to him, both to Mecca, while he staid there, and also to Medina, whither he returned this year. Among the rest; five kings of the tribe of Hamyar professed Mohammedism, and sent ambassadors to notify the same.

In the tenth year Ali was sent into Yaman to propagate the Mohammedan faith there, and, as it is said, converted the whole tribe of Hamdan in one day. Their example was quickly followed by all the inhabitants of that province, except only those of Najran, who, being Christians, chose rather to pay tribute.

Thus was Mohammedism established, and idolatry rooted out, even in Mohammed's life-time (for he died the next year) throughout all Arabia, except only Yama-na, where Moseilama, who set up also for a prophet as Mohammed's competitor, had a great party, and was not reduced till the Khalifat of Abu Becr: and the Arabs, being then united in one faith and under one prince, found themselves in a condition of making those conquests, which extended the Mohammedan faith over so great a part of the world.

*Of the Koran.* The word *Koran*, derived from the verb *karaa*, to read, signifies properly, in Arabic, the reading, or, rather, that which ought to be read; by which name the Mohammedans denote not only the entire book or volume of the Koran, but also any particular chapter or section of it; just as the Jews call either the whole scripture, or any part of it, by the name of *Karah*, or *Mikra*, words of the same origin and import. See AL-KORAN.

Beside this peculiar name, the Koran is also honoured with several appellations, common to other books of scripture: as, *al Farkan*, from the verb *foraka*, to divide or distinguish; not, as the Mohammedan doctors say, because those books are divided into chapters or sections, or distinguish between good and evil; but in the same notion that the Jews use the word *Perek*, or *Pirka*, from the same root, to denote a section or portion of scripture. It is also called *al Mofhaf*, the volume, and all *Kitab*, the book, by way of eminence, which answers to the *Biblia* of the Greeks; and *al Dhikr*, the admonition, which name is also given to the Pentateuch and Gospel.

The Koran is divided into 114 larger portions of very unequal length, which we call *chapters*, but the Arabians *Sowar*, in the singular *Sura*, a word rarely used on any other occasion, and properly signifying a row, order, or a regular series; as a course of bricks in building, or a rank of soldiers in an army; and is the same in use and import with the *Sura*, or *Tora* of the Jews, who also call the fifty three sections of the Pentateuch *Sedarim*, a word of the same signification.

These chapters are not in the manuscript copies distinguished by their numerical order, but by particular titles, which are taken sometimes from a particular matter treated of, or person mentioned therein; but usually from the first word of note, exactly in the same manner as the Jews have named their *Sedarim*; though the word from which some chapters are denominated be very far distant, towards the middle, or perhaps the end of the chapter; which seems ridiculous. But the occasion of this seems to have been, that the verse or passage wherein such word occurs, was, in point of time, revealed and committed to writing before the other verses of the same chapter which precede it in order; and the title being given to the chapter before it was completed, or the passages re-

duced to their present order, the verse from whence such title was taken did not always happen to begin the chapter. Some chapters have two or more titles, occasioned by the difference of the copies.

Some of the chapters having been revealed at Mecca, and others at Medina, the noting this difference makes a part of the title: but the reader will observe that several of the chapters are said to have been revealed partly at Mecca, and partly at Medina; and, as to others, it is yet a dispute among the commentators to which place of the two they belong.

Every chapter is subdivided into smaller portions, of very unequal length also, which we customarily call *verses*: but the Arabic word is *Ayat*, the same with the Hebrew *Ototh*, and signifies *signs*, or *wonders*; such as are the secrets of God, his attributes, works, judgments; and ordinances, delivered in those verses; many of which have their particular titles also, imposed in the same manner as those of the chapters.

Besides these unequal divisions of chapter and verse, the Mohammedans have also divided their Koran into sixty equal portions, which they call *Ahzab*, in the singular *Hizb*, each subdivided into four equal parts; which is also an imitation of the Jews, who have an ancient division of their *Mishna* into sixty portions called *Maschtoth*: but the Koran is more usually divided into thirty sections only, named *Ajza*, from the singular *Joz*, each of twice the length of the former, and in the like manner subdivided into four parts. These divisions are for the use of the readers of the Koran in the royal temples, or in the adjoining chapels where the emperors and great men are interred. There are thirty of these readers belonging to every chapel, and each reads his section every day, so that the whole Koran is read over once a-day.

Next after the title, at the head of every chapter, except only the ninth, is prefixed the following solemn form, by the Mohammedans called the *Bismallah*, IN THE NAME OF THE MOST MERCIFUL GOD: which form they constantly place at the beginning of all their books and writings in general, as a peculiar mark or distinguishing characteristic of their religion, it being counted a sort of impiety to omit it. The Jews, for the same purpose, make use of the form, *In the name of the LORD*, or, *In the name of the great God*: and the eastern Christians that of, *In the name of the Father, and of the Son, and of the Holy Ghost*. But Mohammed probably took this form, as he did many other things, from the Persian Magi, who used to begin their books in these words, *Benam Tezdan bakhshaihygher dadar*; that is, *In the name of the most merciful just God*.

There are twenty-nine chapters of the Koran, which have this peculiarity, that they begin with certain letters of the alphabet, some with a single one, others with more. These letters the Mohammedans believe to be the peculiar marks of the Koran, and to conceal several profound mysteries, the certain understanding of which, the more intelligent confess, has not been communicated to any mortal, their prophet only excepted. Notwithstanding which, some will take the liberty of guessing at their meaning by that species of Cabala called by the Jews *Notarikon*, and suppose the letters to stand for as many words, expressing

expressing the names and attributes of God, his works, ordinances, and decrees; and therefore these mysterious letters, as well as the verses themselves, seem in the Koran to be called signs. Others explain the intent of these letters from their nature or organ, or else from their value in numbers, according to another species of the Jewish Cabala called Gematria; the uncertainty of which conjectures sufficiently appears from their disagreement. Thus, for example, five chapters, one of which is the second, begin with these letters, A. L. M. which some imagine to stand for, *Allah latif magid*; God is gracious and to be glorified; or, *Ana li minni, to me and from me, viz.* belongs all perfection, and proceeds all good; or else for *Ana Allah alam, I am the most wise God*, taking the first letter to mark the beginning of the first word, the second the middle of the second word, and the third the last of the third word; or for *Allah, Gabriel, Mohammed*, the author, revealer, and preacher of the Koran. Others say, that as the letter A belongs to the lower part of the throat, the first of the organs of speech; L to the palate, the middle organ; and M to the lips, which are the last organ; so these letters signify that God is the beginning, middle, and end, or ought to be praised in the beginning, middle, and end, of all our words and actions: or, as the total value of those three letters, in numbers, is seventy-one, they signify, that, in the space of so many years, the religion preached in the Koran should be fully established. The conjecture of a learned Christian is at least as certain as any of the former, who supposes those letters were set there by the *amanuensis*, for *Amar li Mohammed*, i. e. *At the command of Mohammed*, as the five letters prefixed to the nineteenth chapter seem to be there written by a Jewish scribe, for *Cob yaas*, i. e. *Thus he commanded*.

The Koran is universally allowed to be written with the utmost elegance and purity of language, in the dialect of the tribe of Koreish, the most noble and polite of all the Arabians, but with some mixture, though very rarely, of other dialects. It is confessedly the standard of the Arabic tongue, and, as the more orthodox believe, and are taught by the book itself, inimitable by any human pen, (though some sectaries have been of another opinion) and therefore insisted on as a permanent miracle, greater than that of raising the dead, and alone sufficient to convince the world of its divine original.

And to this miracle did Mohammed himself chiefly appeal for the confirmation of his mission, publicly challenging the most eloquent men in Arabia, which was at that time stocked with thousands, whose sole study and ambition it was to excel in elegance of style and composition, to produce even a single chapter that might be compared with it.

The general design of the Koran seems to be this: to unite the professors of the three different religions then followed in the populous country of Arabia, who, for the most part, lived promiscuously, and wandered without guides, the far greater number being idolaters, and the rest Jews and Christians mostly of erroneous and heterodox belief, in the knowledge and worship of one eternal, invisible God, by whose power all things were made, and those which are not may be; the supreme

Governor, Judge, and absolute Lord of the creation; established under the sanction of certain laws, and the outward signs of certain ceremonies, partly of ancient, and partly of novel institution, and enforced by setting before them rewards and punishments, both temporal and eternal: and to bring them all to the obedience of Mohammed, as the prophet and ambassador of God, who, after the repeated admonitions, promises and threats of former ages, was at last to establish and propagate God's religion on earth by force of arms, and to be acknowledged chief pontiff in spiritual matters, as well as supreme prince in temporal.

The great doctrine then of the Koran is the unity of God; to restore which point Mohammed pretended was the chief end of his mission; it being laid down by him, as a fundamental truth, that there never was, nor ever can be, more than one true orthodox religion. For, though the particular laws or ceremonies are only temporary, and subject to alteration, according to the divine direction; yet, the substance of it, being eternal truth, is not liable to change, but continues immutably the same. And he taught, that, whenever this religion became neglected, or corrupted in essentials, God had the goodness to re-inform and re-admonish mankind thereof, by several prophets, of whom Moses and Jesus were the most distinguished, till the appearance of Mohammed, who is their seal, no other being to be expected after him. And the more effectually to engage people to hearken to him, great part of the Koran is employed in relating examples of dreadful punishments formerly inflicted by God on those who rejected and abused his messengers; several of which stories, or some circumstances of them, are taken from the Old and New Testament, but many more from the apocryphal books and traditions of the Jews and Christians of those ages, set up in the Koran as truths in opposition to the scriptures, which the Jews and Christians are charged with having altered; and indeed few or none of the relations or circumstances in the Koran were invented by Mohammed, as is generally supposed, it being easy to trace the greatest part of them much higher, as the rest might be, were more of those books extant, and it was worth while to make the inquiry.

The other part of the Koran is taken up in giving necessary laws and directions, in frequent admonitions to moral and divine virtues, and, above all, to the worshipping and reverencing of the only true God, and resignation to his will; among which are many excellent things intermixed, not unworthy even a Christian's perusal.

But besides these, there are a great number of passages which are occasional, and relate to particular emergencies. For whenever any thing happened which perplexed and gravelled Mohammed, and which he could not otherwise get over, he had constant recourse to a new revelation, as an infallible expedient in all nice cases; and he found the success of this method answer his expectation. It was certainly an admirable and politic contrivance of his to bring down the whole Koran at once to the lowest heaven only, and not to the earth as a bungling prophet would probably have done; for if the whole had been published at once, innumerable objections might have been made, which it would have been very hard if not impossible,

impossible, for him to solve: but as he pretended to have received it by parcels, as God saw proper that they should be published for the conversion and instruction of the people, he had a sure way to answer all emergencies, and to extricate himself with honour from any difficulty which might occur.

That Mohammed was really the author and chief contriver of the Koran, is beyond dispute; though it be highly probable that he had no small assistance in his design from others, as his countrymen failed not to object to him; however, they differed so much in their conjectures as to the particular persons who gave him such assistance, that they were not able, it seems, to prove the charge; Mohammed, it is to be presumed, having taken his measures too well to be discovered. Dr. Puidoux has given the most probable account of this matter, though chiefly from Christian writers, who generally mix such ridiculous fables with what they deliver, that they deserve not much credit.

However it be, the Mohammedans absolutely deny the Koran was composed by their prophet himself, or any other for him; it being their general and orthodox belief that it is of divine original, nay, that it is eternal and uncreated, remaining, as some express it, in the very essence of God: that the first transcript has been from everlasting by God's throne, written on a table of vast bigness, called the *preserved table*, in which are also recorded the divine decrees past and future: that a copy from this table, in one volume on paper, was by the ministry of the angel Gabriel sent down to the lowest heaven, in the month of Ramadan, on the night of *power*: from whence Gabriel revealed it to Mohammed by parcels, some at Mecca, and some at Medina, at different times, during the space of twenty-three years, as the exigency of affairs required; giving him, however, the consolation to shew him the whole (which they tell us was bound in silk, and adorned with gold and precious stones of paradise) once a year; but in the last year of his life he had the favour to see it twice. They say that few chapters were delivered entire, the most part being revealed piece-meal, and written down from time to time by the prophet's amanuenses in such or such a part of such or such a chapter, till they were completed according to the directions of the angel. The first parcel that was revealed is generally agreed to have been the first five verses of the ninety-sixth chapter.

After the new revealed passages had been from the prophet's mouth taken down in writing by his scribe, they were published to his followers, several of whom took copies for their private use, but the far greater number got them by heart. The originals, when returned, were put promiscuously into a chest, observing no order of time, nor which reason it is uncertain when many passages were revealed.

When Mohammed died, he left his revelations in the same disorder, and not digested into the method, such as it is which we now find them in. This was the work of his successor Abu Becr, who, considering that a great number of passages were committed to the memory of Mohammed's followers, many of whom were slain in their wars, ordered the whole to be collected, not only

from the palm-leaves and skins on which they had been written, and which were kept between two boards or covers, but also from the mouths of such as had gotten them by heart. And this transcript, when completed, he committed to the custody of Hafsa the daughter of Omar, one of the prophet's widows.

From this relation it is generally imagined that Abu Becr was really the compiler of the Koran; though, for aught appears to the contrary, Mohammed left the chapters complete as we now have them, excepting such passages as his successor might add or correct from those who had gotten them by heart; what Abu Becr did else being, perhaps, no more than to range the chapters in their present order, which he seems to have done without any regard to time, having generally placed the longest first.

However, in the thirtieth year of the Hejra, Othman being then Khalif, and observing the great disagreement in the copies of the Khoran in the several provinces of the empire, those of Irak, for example, following the reading of Abu Mufa al Ashari, and the Syrians that of Ma'adad Ebn Aswad, he, by advice of the *companions*, ordered a great number of copies to be transcribed from that of Abu Becr, in Hafsa's care, under the inspection of Zeid Ebn Thabet, Abd'allah Ebn Zobair, Said Ebn al As, and Ad'abraham Ebn al Hareth the Makhzumite; whom he directed, that, wherever they disagreed about any word, they should write it in the dialect of the Koreish, in which it was at first delivered. These copies, when made, were dispersed in the several provinces of the empire, and the old ones burnt and suppressed. Though many things in Hafsa's copy were corrected by the above-mentioned supervisors, yet some few various readings still occur.

The fundamental position, on which Mohammed erected the superstructure of his religion, was, That, from the beginning to the end of the world, there has been, and for ever will be, but one true orthodox belief; consisting, as to matter of faith, in the acknowledging of the only true God, and the believing in and obeying such messengers or prophets as he should from time to time send, with proper credentials, to reveal his will to mankind; and, as to matter of practice, in the observance of the immutable and eternal laws of right and wrong, together with such other precepts and ceremonies as God should think fit to order for the time being, according to the different dispensations in different ages of the world: for these last, he allowed, were things indifferent in their own nature; and became obligatory by God's positive precept only; and were therefore temporary, and subject to alteration, according to his will and pleasure. And to this religion he gives the name of Islam, which word signifies *resignation*, or *submission* to the service and commands of God; and is used as the proper name of the Mohammedan religion, which they will also have to be the same at bottom with that of all the prophets from Adam.

Under pretext that this eternal religion was in his time corrupted, and professed in its purity by no one sect of men, Mohammed pretended to be a prophet sent by God, to reform those abuses which had crept into it, and to reduce it to its primitive simplicity; with the addition,

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however of peculiar laws and ceremonies, some of which had been used in former times, and others were now first instituted. And he comprehended the whole substance of his doctrine under these two propositions, or articles of faith, *viz.* that there is but one God, and that himself was the apostle of God; in consequence of which latter article, all such ordinances and institutions as he thought fit to establish must be received as obligatory and of divine authority.

The Mohammedans divide their religion, which they call Islam, into two distinct parts; Iman, *i. e.* *faith*, or theory; and Din, *i. e.* *religion*, or practice; and teach that it is built on five fundamental points, one belonging to faith, and the other four to practice.

The first is, that *there is no god but the true God*; and that Mohammed is his apostle. Under which they comprehend six distinct branches, *viz.* 1. *Belief in God*; 2. *In his angels*; 3. *In his scriptures*; 4. *In his prophets*; 5. *In the resurrection and day of judgment*; and, 6. *In God's absolute decree and predetermination both of good and evil.*

The four points relating to practice are, 1. *Prayer*, under which are comprehended those washings or purifications which are necessary preparations required before prayer; 2. *Alms*; 3. *Fasting*; and, 4. *The pilgrimage to Mecca.*

That both Mohammed, and those among his followers who are reckoned orthodox, had and continue to have just and true notions of God and his attributes, appears so plain from the Koran itself, and all the Mohammedan divines, that it would be loss of time to refute those who suppose the God of Mohammed to be different from the true God, and only a fictitious deity, or idol of his own creation.

The existence of angels, and their purity, are absolutely required to be believed in the Koran; and he is reckoned an infidel who denies there are such beings, or hates any of them, or asserts any distinction of sexes among them. They believe them to have pure and subtle bodies, created of fire; that they neither eat nor drink, nor propagate their species; that they have various forms and offices; some adoring God in different postures, others singing praises to him, or interceding for mankind. They hold, that some of them are employed in writing down the actions of men, others in carrying the throne of God and other services.

The four angels, whom they look on as more eminently in God's favour, and often mention on account of the offices assigned them, are Gabriel, to whom they give several titles, particularly those of the *holy spirit*, and the *angel of revelations*, supposing him to be honoured by God with a greater confidence than any other, and to be employed in writing down the divine decrees; Michael, the friend and protector of the Jews; Azrael, the *angel of death*, who separates mens souls from their bodies; and Israfil, whose office it will be to found the trumpet at the resurrection. The Mohammedans also believe, that two guardian angels attend on every man, to observe and write down his actions, being changed every day, and therefore called al Moakkibat, or the angels who continually succeed one another,

The devil, whom Mohammed names Eblis, from his *despair*, was once one of those angels who are nearest to God's presence, called Azazil; and fell, according to the doctrine of the Koran, for refusing to pay homage to Adam at the command of God.

Besides angels and devils, the Mohammedans are taught by the Koran to believe an intermediate order of creatures, which they call Jin or Genii, created also of fire, but of a grosser fabric than angels; since they eat and drink, and propagate their species, and are subject to death. Some of these are supposed to be good, and others bad, and capable of future salvation or damnation, as men are; whence Mohammed pretended to be sent for the conversion of genii as well as men.

As to the scriptures, the Mohammedans are taught by the Koran, that God, in divers ages of the world, gave revelations of his will in writing to several prophets, the whole and every word of which it is absolutely necessary for a good Moslem to believe. The number of these sacred books were, according to them, 104. Of which ten were given to Adam, fifty to Seth, thirty to Edris or Enoch, ten to Abraham; and the other four, being the Pentateuch, the Psalms, the Gospel, and the Koran, were successively delivered to Moses, David, Jesus, and Mohammed; which last being the seal of the prophets, those revelations are now closed, and no more are to be expected. All these divine books, except the four last, they agree to be now entirely lost, and their contents unknown; though the Sabians have several books which they attribute to some of the antediluvian prophets. And of those four, the Pentateuch, Psalms, and Gospel, they say, have undergone so many alterations and corruptions, that, though there may possibly be some part of the true word of God therein, yet no credit is to be given to the present copies in the hands of the Jews and Christians. The Mohammedans have also a gospel in Arabic, attributed to St Barnabas, wherein the history of Jesus Christ is related in a manner very different from what we find in the true Gospels, and correspondent to those traditions which Mohammed has followed in his Koran. Of this Gospel the Moriscoes in Africa have a translation in Spanish; and there is, in the library of prince Eugene of Savoy, a manuscript of some antiquity, containing an Italian translation of the same Gospel, made, it is to be supposed, for the use of renegades. This book appears to be no original forgery of the Mohammedans, though they have no doubt interpolated and altered it since, the better to serve their purpose; and in particular, instead of the Paraclete or Comforter, they have in this apocryphal gospel inserted the word Periclyte, that is, the *famous or illustrious*, by which they pretend their prophet was foretold by name, that being the signification of Mohammed in Arabic: and this they say to justify that passage of the Koran, where Jesus Christ is formally asserted to have foretold his coming, under his other name of Ahmed, which is derived from the same root as Mohammed, and of the same import. From these or some other forgeries of the same stamp, it is that the Mohammedans quote several passages, of which there are not the least footsteps, in the *New Testament.*

The number of the prophets, which have been from time

time to time sent by God into the world, amounts to no less than 224,000, according to one Mohammedan tradition, or to 124,000, according to another; among whom 313 were apostles, sent with special commissions to reclaim mankind from infidelity and superstition; and six of them brought new laws or dispensations, which successively abrogated the preceding: these were Adam, Noah, Abraham, Moses, Jesus, and Mohammed. All the prophets in general, the Mohammedans believe to have been free from great sins and errors of consequence, and professors of one and the same religion, that is, Islam, notwithstanding the different laws and institutions which they observed. They allow of degrees among them, and hold some of them to be more excellent and honourable than others. The first place they give to the revealers and establishers of new dispensations, and the next to the apostles.

In this great number of prophets, they not only reckon divers patriarchs and persons named in scripture, but not recorded to have been prophets, (wherein the Jewish and Christian writers have sometimes led the way,) as Adam, Seth, Lot, Ismael, Nun, Joshua, &c. and introduce some of them under different names, as Enoch, Heber, and Jethro, who are called, in the Koran, Edris, Hud, and Shoaib; but several others whose very names do not appear in scripture (though they endeavour to find some persons there to fix them on) as, Saleh, Khedr, Dhu'lkeff, &c.

The next article of faith required by the Koran is the belief of a general resurrection and a future judgment.

When a corpse is laid in the grave, they say he is received by an angel, who gives him notice of the coming of the two Examiners; which are two black livid angels, of a terrible appearance, named Monker and Nakir. These order the dead person to sit upright, and examine him concerning his faith, as to the unity of God, and the mission of Mohammed: if he answer rightly, they suffer the body to rest in peace, and it is refreshed by the air of paradise; but, if not, they beat him on the temples with iron maces, till he roars out for anguish so loud that he is heard by all from east to west, except men and genii. Then they press the earth on the corpse, which is gnawed and stung till the resurrection by ninety-nine dragons, with seven heads each; or, as others say, their fins will become venomous beasts, the grievous ones stinging like dragons, the smaller like scorpions, and the others like serpents: circumstances which some understand in a figurative sense.

As to the soul, they hold, that, when it is separated from the body by the angel of death, who performs his office with ease and gentleness towards the good, and with violence towards the wicked, it enters into that state which they call *al Berzakh*, or *the interval* between death and the resurrection. If the departed person was a believer, they say two angels meet it, who convey it to heaven, that its place there may be assigned, according to its merit and degree. For they distinguish the souls of the faithful into three classes; the first of prophets, whose souls are admitted into paradise immediately; the second of martyrs, whose spirits, according to a tradition of Mohammed, rest in the crops of green birds, which eat

of the fruits and drink of the rivers of paradise; and the third of other believers, concerning the state of whose souls before the resurrection there are various opinions.

Though some among the Mohammedans have thought that the resurrection will be merely spiritual, and no more than the returning of the soul to the place whence it first came (an opinion defended by Ebn Sina, and called by some the *opinion of the philosophers*;) and others, who allow man to consist of body only, that it will be merely corporeal; the received opinion is, that both body and soul will be raised; and their doctors argue strenuously for the possibility of the resurrection of the body, and dispute with great subtilty concerning the manner of it. But Mohammed has taken care to preserve one part of the body, whatever becomes of the rest, to serve for a basis of the future edifice, or rather a leaven for the mass which is to be joined to it. For he taught, that a man's body was entirely consumed by the earth, except only the bone called *al Ajb*, which we name the *os coccygis*, or rump bone; and that, as it was the first formed in the human body, it will also remain uncorrupted till the last day, as a seed from whence the whole is to be renewed: and this, he said, would be effected by a forty days rain, which God should send, and which would cover the earth to the height of twelve cubits, and cause the bodies to sprout forth like plants. Herein, also, is Mohammed beholden to the Jews; who say the same things of the bone *Luz*, excepting that what he attributes to a great rain, will be effected, according to them, by a dew, impregnating the dust of the earth.

The time of the resurrection the Mohammedans allow to be a perfect secret to all but God alone; the angel Gabriel himself acknowledging his ignorance in this point, when Mohammed asked him about it. However, they say, the approach of that day may be known from certain signs which are to precede it. These signs they distinguish into two sorts, the lesser, and the greater.

The lesser signs are, 1. The decay of faith among men. 2. The advancing of the meanest persons to eminent dignity. 3. That a maid-servant shall become the mother of her mistress (or master;) by which is meant, either that towards the end of the world men shall be much given to sensuality, or that the Mohammedans shall then take many captives. 4. Tumults and seditions. 5. A war with the Turks. 6. Great distress in the world, so that a man when he passes by another's grave, shall say, Would to God I were in his place. 7. That the provinces of Irak and Syria shall refuse to pay their tribute. And, 8. That the buildings of Medina shall reach to Ahab, or Yahab.

The greater signs are,

1. The sun's rising in the west; which some have imagined it originally did.

2. The appearance of the beast, which shall rise out of the earth, in the temple of Mecca, or on mount Safa, or in the territory of Tayef, or some other place. This beast, they say, is to be sixty cubits high; though others, not satisfied with so small a size, will have her reach to the clouds and to heaven, when her head only is out; and that she will appear for three days, but shew only a third part of her body. They describe this monster, as

to her form, to be a compound of various species; having the head of a bull, the eyes of a hog, the ears of an elephant, the horns of a stag, the neck of an ostrich, the breast of a lion, the colour of a tiger, the back of a cat, the tail of a ram, the legs of a camel, and the voice of an ass. Some say this beast is to appear three times in several places, and that she will bring with her the rod of Moses and the seal of Solomon; and, being so swift that none can overtake or escape her, will with the first strike all the believers on the face, and mark them with the word *mumen* *i. e.* believer; and with the latter will mark the unbelievers on the face likewise, with the word *Cafer*, *i. e.* *infidel*, that every person may be known for what he really is. They add that the same beast is to demonstrate the vanity of all religions except Islam, and to speak Arabic. All this stuff seems to be the result of a confused idea of the beast in the Revelations.

3. War with the Greeks, and the taking Constantinople by 70,000 of the posterity of Isaac, who shall not win that city by force of arms, but the walls shall fall down while they cry out, *There is no God but God: God is most great!* As they are dividing the spoil, news will come to them of the appearance of Antichrist; whereupon they shall leave all and return back.

4. The coming of Antichrist, whom the Mohammedans call *Masib al Dajjal*, *i. e.* the false or lying Christ, and simply *al Dajjal*. He is to be one eyed, and marked on the forehead with the letters C. F. R. signifying *Cafer* or *infidel*. They say that the Jews give him the name of *Messiah Ben David*, and pretend he is to come in the last days, and to be lord both of land and sea, and that he will restore the kingdom to them.

5. The descent of Jesus on earth. They pretend that he is to descend near the white tower to the east of Damascus, when the people are returned from the taking of Constantinople: that he is to embrace the Mohammedan religion, marry a wife, get children, kill Antichrist and at length die after forty years, or, according to others, twenty four years continuance on earth. Under him, they say, there will be great security, and plenty in the world, all hatred and malice being laid aside; when lions and camels, bears and sheep, shall live in peace, and a child shall play with serpents unurt.

6. War with the Jews; of whom the Mohammedans are to make a prodigious slaughter. the very trees and stones discovering such of them as hide themselves, except only the tree called *Gharkad*, which is the tree of the Jews.

7. The eruption of Gog and Magog, or, as they are called in the east, *Yajuj and Majuj*; of whom many things are related in the Koran and the traditions of Mohammed. These barbarians, they tell us, having passed the lake of Tiberias, which the vanguard of their vast army will drink dry, will come to Jerusalem, and there greatly distress Jesus and his companions; till, at his request, God will destroy them, and fill the earth with their carcases, which, after some time, God will send birds to carry away, at the prayers of Jesus and his followers. Their bows, arrows, and quivers, the Moslems will burn for seven years together; and, at last, God will send a rain to cleanse the earth, and to make it fertile.

8. A smoke, which shall fill the whole earth.

9. An eclipse of the moon. Mohammed is reported to have said, that there would be three eclipses before the last hour; one to be seen in the east, another in the west, and the third in Arabia

10. The returning of the Arabs to the worship of Allat and al Uzza, and the rest of their ancient idols, after the decease of every one in whose heart there was faith equal to a grain of mustard-seed, none but the very worst of men being left alive. For God, they say, will send a cold odoriferous wind, blowing from Syria Damascus, which shall sweep away the souls of all the faithful, and the Koran itself, so that men will remain in the grossest ignorance for an hundred years.

11. The discovery of a vast heap of gold and silver by the retreating of the Euphrates, which will be the destruction of many.

12. The demolition of the Caaba, or temple of Mecca, by the Ethiopians

13. The speaking of beasts and inanimate things.

14. The breaking out of fire in the province of Hejaz; or, according to others, in Yaman.

15. The appearance of a man of the descendants of Kahtan, who shall drive men before him with his staff.

16. The coming of the Mohdi, or director; concerning whom Mohammed prophesied, that the world should not have an end till one of his own family should govern the Arabians, whose name should be the same with his own name, and whose father's name should also be the same with his father's name; and who should fill the earth with righteousness. This person the Shites believe to be now alive, and concealed in some secret place, till the time of his manifestation; for they suppose him no other than the last of the twelve Imams, named Mohammed Abu'lkasem, as their prophet was: and the son of Hassan al Askari, the eleventh of that succession. He was born at Sermanrai in the 255th year of the Hejra. From this tradition, it is to be presumed, an opinion pretty current among the Christians took its rise, that the Mohammedans are in expectation of their prophet's return.

17. A wind which shall sweep away the souls of all who have but a grain of faith in their hearts, as has been mentioned under the tenth sign.

These are the greater signs, which, according to their doctrine, are to precede the resurrection, but till leave the hour of it uncertain; for the immediate sign of its being come will be the first blast of the trumpet; which they believe will be sounded three times. The first they call the *blast of consternation*; at the hearing of which all creatures in heaven and earth shall be struck with terror, except those whom God shall please to exempt from it. The effects attributed to this first sound of the trumpet are very wonderful; for they say, the earth will be shaken, and not only all buildings, but the very mountains levelled; that the heavens shall melt, the sun be darkened, the stars fall, on the death of the angels, who, as some imagine, hold them suspended between heaven and earth; and the sea shall be troubled and dried up, or, according to others, turned into flames, the sun, moon, and stars being thrown into it: the Koran, to express the greatness of the terror of that day, adds, that women who

give suck shall abandon the care of their infants, and even the she camels which have gone ten months with young (a most valuable part of the substance of that nation) shall be utterly neglected. A farther effect of this blast will be that concourse of beasts mentioned in the Koran, though some doubt whether it be to precede the resurrection or not. They who suppose it will precede, think that all kinds of animals, forgetting their respective natural fierceness and timidity, will run together into one place, being terrified by the sound of the trumpet and the sudden shock of nature.

The Mohammedans believe that this first blast will be followed by a second, which they call the *blast of examination*; when all creatures both in heaven and earth shall die or be annihilated, except those which God shall please to exempt from the common fate; and this, they say, shall happen in the twinkling of an eye, nay in an instant; nothing surviving except God alone, with paradise and hell, and the inhabitants of those two places, and the throne of glory. The last who shall die will be the angel of death.

Fo'ty years after this will be heard the *blast of resurrection*, when the trumpet shall be sounded the third time by Israfil, who, together with Gabriel and Michael, will be previously restored to life, and, standing on the rock of the temple of Jerusalem, shall, at God's command, call together all the dry and rotten bones, and other dispersed parts of the bodies, and the very hairs, to judgment. This angel, having, by the divine order, set the trumpet to his mouth, and called together all the souls from all parts, will throw them into his trumpet, from whence, on his giving the last sound, at the command of God, they will fly forth like bees, and fill the whole space between heaven and earth, and then repair to their respective bodies, which the opening earth will suffer to arise; and the first who shall so arise, according to a tradition of Mohammed, will be himself. For this birth the earth will be prepared by the rain above mentioned, which is to fall continually for forty years and will resemble the seed of a man, and be supplied from the water under the throne of God, which is called *living water*; by the efficacy and virtue of which the dead bodies shall spring forth from their graves, as they did in their mother's womb, or as corn sprouts forth by common rain, till they become perfect, after which breath will be breathed into them, and they will sleep in their sepulchres till they are raised to life at the last trump.

When those who have risen shall have waited the limited time, the Mohammedans believe God will at length appear to judge them; Mohammed undertaking the office of intercessor after it shall have been declined by *Adam*, *Noah*, *Abraham*, and *Jesus*, who shall beg deliverance only for their own souls. They say, that on this solemn occasion God will come in the clouds surrounded by angels, and will produce the books wherein the actions of every person are recorded by their guardian angels, and will command the prophets to bear witness against those to whom they have been respectively sent. Then every one will be examined concerning all his words and actions, uttered and done by him in this life; not as if God needed any information in these respects, but to oblige the per-

son to make public confession and acknowledgment of God's justice. The particulars of which they shall give an account, as Mohammed himself enumerated them, are, of their time, how they spent it; of their wealth, by what means they acquired it, and how they employed it; of their bodies, wherein they exercised them; of their knowledge and learning, what use they made of them. To the questions we have mentioned each person shall answer, and make his defence in the best manner he can endeavouring to excuse himself by casting the blame of his evil deeds on others; so that a dispute shall arise even between the soul and the body, to which of them their guilt ought to be imputed: the soul saying, *O Lord, my body I received from thee; for thou createdst me without a hand to lay hold with, a foot to walk with, an eye to see with, or an understanding to apprehend with, till I came and entered into this body; therefore punish it eternally, but deliver me.* The body, on the other side, will make this apology: *O Lord, thou createdst me like a stock of wood, having neither hand that I could lay hold with, nor foot that I could walk with, till this soul, like a ray of light, entered into me, and my tongue began to speak, my eye to see, and my foot to walk; therefore punish it eternally, but deliver me.* But God will propound to them the following parable of the blind man and the lame man, which, as well as the preceding dispute, was borrowed by the Mohammedans from the Jews. A certain king, having a pleasant garden, in which were ripe fruits, set two persons to keep it, one of whom was blind, and the other lame; the former not being able to see the fruit, nor the latter to gather it; the lame man, however, seeing the fruit, persuaded the blind man to take him upon his shoulders and by that means he easily gathered the fruit; which they divided between them. The lord of the garden coming some time after, and inquiring after his fruit, each began to excuse himself; the blind man said he had no eyes to see with, and the lame man that he had no feet to approach the trees. But the king, ordering the lame man to be set on the blind, passed sentence on and punished them both. And in the same manner will God deal with the body and the soul. As these apologies will not avail on that day, so will it also be in vain for any one to deny his evil actions, since men and angels, and his own members, nay, the very earth itself, will be ready to bear witness against him.

At this examination they also believe, that each person will have the book wherein all the actions of his life are written delivered to him; which books the righteous will receive in their right hand, and read with great pleasure and satisfaction; but the ungodly will be obliged to take them, against their wills, in their left, which will be bound behind their backs, their right hand being tied up to their necks,

To shew the exact justice which will be observed on this great day of trial, the next thing they describe is the *balance*, wherein all things shall be weighed. They say it will be held by Gabriel; and that it is of so vast a size, that its two scales, one of which hangs over paradise, and the other over hell, are capacious enough to contain both heaven and earth. Though some are willing to understand what is said in the Koran concerning

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this balance allegorically, and only as a figurative representation of God's equity; yet the more ancient and orthodox opinion is, that they are to be taken literally; and since words and actions, being mere accidents, are not capable of being themselves weighed they say that the books wherein they are written will be thrown into the scales, and according as those wherein the good or evil actions are recorded shall preponderate, sentence will be given: those whose balances laden with good works shall be heavy, will be saved; but those whose balances are light, will be condemned. Nor will any one have cause to complain that God suffers any good action to pass unrewarded, because the wicked for the good they do have their reward in this life, and therefore can expect no favour in the next.

This examination being past, and every one's works weighed in a just balance, that mutual retaliation will follow, according to which every creature will take vengeance one of another, or have satisfaction made them for the injuries which they have suffered. And, since there will then be no other way of returning like for like, the manner of giving this satisfaction will be by taking away a proportional part of the good works of him who offered the injury, and adding it to those of him who suffered it. Which being done, if the angels (by whose ministry this is to be performed) say, *Lord, we have given to every one his due, and there remaineth of this person's good works so much as equalleth the weight of an ant*, God will, of his mercy, cause it to be doubled unto him, that he may be admitted into paradise; but if, on the contrary, his good works be exhausted, and there remain evil works only, and there be any who have not yet received satisfaction from him, God will order that an equal weight of their sins be added unto his, that he may be punished for them in their stead, and he will be sent to hell laden with both. This will be the method of God's dealing with mankind. As to brutes, after they shall have likewise taken vengeance of one another, he will command them to be changed into dust; wicked men being reserved to more grievous punishment, so that they shall cry out, on hearing this sentence passed on the brutes, *Would to God that we were dust also*. As to the genii, many Mohammedans are of opinion, that such of them as are true believers, will undergo the same fate as the irrational animals, and have no other reward than the favour of being converted into dust; and for this they quote the authority of their prophet.

The trials being over, and the assembly dissolved, the Mohammedans hold, that those who are to be admitted into paradise will take the right hand way, and those who are destined to hell fire will take the left; but both of them must first pass the bridge called in Arabic *al Sirat*, which they say is laid over the midst of hell, and describe to be finer than a hair and sharper than the edge of a sword; so that it seems very difficult to conceive how any one shall be able to stand upon it: for which reason, most of the sect of the Motazalites reject it as a fable; though the orthodox think it a sufficient proof of the truth of this article, that it was seriously affirmed by him who never asserted a falsehood, meaning their prophet; who, to add to the difficulty of the passage, has likewise declared, that this

bridge is beset on each side with briars and hooked thorns; which will however be no impediment to the good, for they shall pass with wonderful ease and swiftness, like lightning, or the wind, Mohammed and his Moslems leading the way; whereas the wicked, what with the slipperiness and extreme narrowness of the path, the intangling of the thorns, and the extinction of the light which directed the former to paradise, will soon miss their footing, and fall down headlong into hell, which is gaping beneath them.

As to the punishment of the wicked, the Mohammedans are taught, that hell is divided into seven stories or apartments, one below another, designed for the reception of as many distinct classes of the damned. The first, which they call *Jehennem*, they say, will be the receptacle of those who acknowledged one God, that is, the wicked Mohammedans, who, after having there been punished according to their demerits, will at length be released. The second, named *Ladha*, they assign to the Jews; the third, named *al Hotama*, to the Christians; the fourth, named *al Sair*, to the Sabians; the fifth, named *Sakar*, to the Magians; the sixth, named *al Jahim*, to the idolaters; and the seventh, which is the lowest and worst of all, and is called *al Hawyat*, to the hypocrites, or those who outwardly professed some religion, but in their hearts were of none. Over each of these apartments they believe there will be set a guard of angels, nineteen in number; to whom the damned will confess the just judgment of God, and beg them to intercede with him for some alleviation of their pain, or that they may be delivered by being annihilated.

Mohammed has, in his Koran and traditions, been very exact in describing the various torments of hell, which, according to him, the wicked will suffer both from intense heat and excessive cold. We shall however enter into no detail of them here, but only observe, that the degrees of these pains will also vary in proportion to the crimes of the sufferer, and the apartment he is condemned to; and that he who is punished the most lightly of all will be shod with shoes of fire, the fervor of which will cause his skull to boil like a cauldron. The condition of these unhappy wretches, as the same prophet teaches, cannot be properly called either life or death; and their misery will be greatly increased by their despair of being ever delivered from that place, since, according to that frequent expression in the Koran, *they must remain therein for ever*. It must be remarked, however, that the infidels alone will be liable to eternity of damnation; for the Moslems, or those who have embraced the true religion, and have been guilty of heinous sins, will be delivered thence after they shall have expiated their crimes by their sufferings. The time which these believers shall be detained there, according to a tradition handed down from their prophet, will not be less than 900 years, nor more than 7000. And, as to the manner of their delivery, they say that they shall be distinguished by the marks of prostration on those parts of their bodies with which they used to touch the ground in prayer, and over which the fire will therefore have no power; and that, being known by this characteristic, they will be released by the mercy of God, at the intercession

cession of Mohammed and the blessed; whereupon those who shall have been dead, will be restored to life, as has been said; and those whose bodies shall have contracted any sootiness or filth from the flames and smoke of hell, will be immersed in one of the rivers of paradise, called the *river of life*, which will wash them whiter than pearls.

The righteous, as the Mohammedans are taught to believe, having surmounted the difficulties, and passed the sharp bridge above-mentioned, before they enter paradise, will be refreshed by drinking at the *pond* of their prophet, who describes it to be an exact square of a month's journey in compass; its water, which is supplied by two pipes from al Cawthar, one of the rivers of paradise, being whiter than milk or silver, and more odoriferous than musk, with as many cups set around it as there are stars in the firmament; of which water whoever drinks will thirst no more for ever. This is the first taste which the blessed will have of their future and now near approaching felicity.

Though paradise be so very frequently mentioned in the Koran, yet it is a dispute among the Mohammedans whether it be already created, or be to be created hereafter; the Motazites and some other sectaries asserting that there is not at present any such place in nature, and that the paradise which the righteous will inhabit in the next life will be different from that from which Adam was expelled. However, the orthodox profess the contrary, maintaining that it was created even before the world, and describe it, from their prophet's traditions, in the following manner.

They say it is situate above the seven heavens (or in the seventh heaven) and next under the throne of God; and, to express the amenity of the place, tell us, that the earth of it is of the finest wheat flour, or of the purest musk, or, as others will have it, of saffron: that its stones are pearls and jacinths, the walls of its buildings enriched with gold and silver, and that the trunks of all its trees are of gold; among which the most remarkable is the tree called Tuba, or the tree of happiness. Concerning this tree, they fable, that it stands in the palace of Mohammed, though a branch of it will reach to the house of every true believer; that it will be laden with pomegranates, grapes, dates, and other fruit, of surprising bigness, and of tastes unknown to mortals. So that, if a man desire to eat of any particular kind of fruit, it will immediately be presented him; or, if he chuse flesh, birds ready dressed will be set before him, according to his wish. They add, that the boughs of this tree will spontaneously bend down to the hand of the person who would gather of its fruits, and that it will supply the blessed not only with food, but also with silken garments, and beasts to ride on ready saddled and bridled, and adorned with rich trappings, which will burst forth from its fruits; and that this tree is so large, that a person, mounted on the swiftest horse, would not be able to gallop from one end of its shade to the other in a hundred years.

As plenty of water is one of the greatest additions to the pleasantness of any place, the Koran often speaks of the rivers of paradise as a principal ornament thereof: some of these rivers, they say, flow with water, some

with milk, some with wine, and others with honey; all taking their rise from the root of the tree Tuba.

But all these glories will be eclipsed by the resplendent and ravishing girls of paradise, called, from their large black eyes, *Hur al oyan*, the enjoyment of whose company will be a principal felicity of the faithful. These, they say, are created, not of clay, as mortal women are, but of pure musk; being, as their prophet often asserts in his Koran, free from all natural impurities, defects, and inconveniences incident to the sex, of the strictest modesty, and secluded from public view in pavilions of hollow pearls, so large, that, as some traditions have it, one of them will be no less than four parasangs (or, as others say, sixty miles) long, and as many broad.

The name which the Mohammedans usually give to this happy mansion, is *al Jannat*, or *the garden*; and sometimes they call it, with an addition, *Jannat al Ferdaws*, *the garden of paradise*; *Jannat Aden*, *the garden of Eden*, (though they generally interpret the word *Eden*, not according to its acceptation in Hebrew, but according to its meaning in their own tongue, where in it signifies a *settled or perpetual habitation*;) *Jannat al Marwa*, *the garden of abode*; *Jannat al Naim*, *the garden of pleasure*; and the like: by which several appellations, some understand so many different gardens, or at least places of different degrees of felicity, (for they reckon no less than an hundred such in all,) the very meanest whereof will afford its inhabitants so many pleasures and delights, that one would conclude they must even sink under them, had not Mohammed declared, that, in order to qualify the blessed for a full enjoyment of them, God will give to every one the abilities of an hundred men.

The sixth great point of faith, which the Mohammedans are taught by the Koran to believe, is God's absolute decree and predestination both of good and evil. For the orthodox doctrine is, that whatever hath or shall come to pass in this world, whether it be good, or whether it be bad, proceedeth entirely from the divine will, and is irrevocably fixed and recorded from all eternity in the preserved table: God having secretly predetermined not only the adverse and prosperous fortune of every person in this world, in the most minute particulars, but also his faith or infidelity, his obedience or disobedience, and consequently his everlasting happiness or misery after death; which fate or predestination it is not possible, by any foresight or wisdom, to avoid.

Of this doctrine Mohammed makes great use in his Koran for the advancement of his designs; encouraging his followers to fight without fear, and even desperately, for the propagation of their faith, by representing to them that all their caution could not avert their inevitable destiny, or prolong their lives for a moment; and deterring them from disobeying or rejecting him as an impostor, by setting before them the danger they might thereby incur of being, by the just judgment of God, abandoned to seduction, hardness of heart, and a reprobate mind, as a punishment for their obstinacy.

Of the four fundamental points of religious practice required by the Koran, the first is *prayer*, under which are also comprehended those legal washings or purifications which are necessary preparations thereto.

Of these purifications there are two degrees, one called *Ghoſſ*, being a total immerſion or bathing of the body in water; and the other called *Wodu*, (by the Perfians, *Abdeſſ*), which is the waſhing of their faces, hands, and feet, after a certain manner. The firſt is required in ſome extraordinary caſes only, as after having lain with a woman, or been polluted by emission of ſeed, or by approaching a dead body; women alſo being obliged to it after their courſes or childbirth. The latter is the ordinary ablution in common caſes, and before prayer, and muſt neceſſarily be uſed by every perſon before he can enter upon that duty. It is performed with certain formal ceremonies, which have been deſcribed by ſome writers, but much eaſier apprehended by ſeeing them done, than by the beſt deſcription.

That his followers might be more punctual in this duty, Mohammed is ſaid to have declared, that *the practice of religion is founded on cleanlineſs*, which is the *one half of the faith, and the key of prayer*, without which it will not be heard by God. That theſe expreſſions may be the better underſtood, *al Ghazali* reckons four degrees of purification; of which the firſt is the cleaning of the body from all pollution, filth, and excrements; the ſecond, the cleaning of the members of the body from all wickedneſs and unjuſt actions; the third, the cleaning the heart from all blameable inclinations and odious vices; and the fourth, the purging a man's ſecret thoughts from all affections which may divert their attendance on God: adding, that the body is but as the outward ſhell, in reſpect to the heart, which is as the kernel.

Circumciſion, though it be not ſo much as once mentioned in the Koran, is yet held, by the Mohammedans, to be an ancient divine inſtitution, confirmed by the religion of iſlam, and, though not ſo abſolutely neceſſary but that it may be diſpenſed with in ſome caſes, yet highly proper and expedient. The Arabs uſed this rite for many ages before Mohammed, having probably learned it from Iſhmael, though not only his deſcendants, but the Hamyarites and other tribes praſticed the ſame. The Iſhmaelites, we are told, uſed to circumciſe their children, not on the eighth day, as is the cuſtom of the Jews, but when about twelve or thirteen years old, at which age their father underwent that operation; and the Mohammedans imitate them ſo far as not to circumciſe children before they be able at leaſt diſtinctly to pronounce that profeſſion of their faith, *There is no God but God, Mohammed is the apoſtle of God*; but pitch on what age they pleaſe for the purpoſe, between ſix or ſixteen, or thereabouts.

Prayer was, by Mohammed, thought ſo neceſſary a duty, that he uſed to call it *the pillar of religion*, and *the key of para-diſe*; and when the Thakiſites, who dwelt at Tayef, ſending, in the ninth year of the Hejra, to make their ſubmiſſion to that prophet, after the keeping of their favourite idol had been denied them, begged, at leaſt, that they might be diſpenſed with as to their ſaying of their appointed prayers, he answered, *That there could be no good in that religion wherein was no prayer*.

That ſo important a duty, therefore, might not be neglected, Mohammed obliged his followers to pray five times every twenty-four hours, at certain ſtated times;

*viz.* 1. In the morning, before ſun-riſe: 2. When noon is paſt, and the ſun begins to decline from the meridian: 3. In the afternoon, before ſun-ſet: 4. In the evening, after ſun-ſet, and before day be ſhut in: and, 5. After the day is ſhut in, and before the firſt watch of the night. For this inſtitution he pretended to have received the divine command from the throne of God himſelf, when he took his night-journey to heaven; and the obſerving of the ſtated times of prayer is frequently inſiſted on in the Koran, though they be not particularly preſcribed therein. Accordingly, at the aforeſaid times, of which public notice is given by the Muedhdhins, or Criers, from the ſteeples of their Moſques, (for they uſe no bells,) every conſcientious Moſlem prepares himſelf for prayer, which he performs either in the Moſque or any other place, provided it be clean, after a preſcribed form, and with a certain number of praifes or ejaculations, (which the more ſcrupulous count by a ſtring of beads and uſing certain poſtures of worſhip;) all which have been particularly ſet down and deſcribed, though with ſome few miſtakes, by other writers, and ought not to be abridged, unleſs in ſome ſpecial caſes, as on a journey, on preparing for battle, &c.

For the regular performance of the duty of prayer among the Mohammedans, beſides the particulars above-mentioned, it is alſo requiſite that they turn their faces, while they pray, towards the temple of Mecca; the quarter where the ſame is ſituate being, for that reaſon, pointed out within their moſques by a nich, which they call *al Mehrab*; and without, by the ſituation of the doors opening into the galleries of the ſteeples: there are, alſo, tables calculated for the ready finding out their Keblah, or part towards which they ought to pray, in places where they have no other direction.

The next point of the Mohammedan religion is the giving of alms; which are of two ſorts, *legal* and *voluntary*. The *legal alms* are of indiſpenſable obligation, being commanded by the law, which directs and determines both the portion which is to be given, and of what things it ought to be given; but the *voluntary alms* are left to every one's liberty, to give more or leſs, as he ſhall ſee fit. The former kind of alms ſome think to be properly called *Zacat*, and the latter *Sadakats*; though this name be alſo frequently given to the legal alms. They are called *Zacat*, either becauſe they *increase* a man's ſtore by drawing down a bleſſing thereon, and produce in his ſoul the virtue of liberality; or becauſe they *purify* the remaining part of one's ſubſtance from pollution, and the ſoul from the filth of avarice; and *Sadakats*, becauſe they are a proof of a man's ſincerity in the worſhip of God. Some writers have called the legal alms *tithes*, but improperly, ſince in ſome caſes they fall ſhort, and in others exceed that proportion.

The third point of religious praſtice is faſting; a duty of ſo great moment, that Mohammed uſed to ſay it was *the gate of religion*, and that *the odour of the mouth of him who faſteth is more grateful to God than that of muſk*; and *al Ghazali* reckons faſting *one fourth part of the faith*. According to the Mohammedan divines, there are three degrees of faſting: 1. The reſtraining the belly and other parts of the body from ſatiſfying their luſts; 2. The reſtraining the ears, eyes, tongue, hands, feet, and other

ther members from sin; and, 3. The fasting of the heart from worldly cares, and restraining the thoughts from every thing besides God.

The Mohammedans are obliged, by the express command of the Koran, to fast the whole month of Ramadan, from the time the new moon first appears, till the appearance of the next new moon; during which time they must abstain from eating, drinking, and women, from day-break till night or sun-set. And this injunction they observe so strictly, that, while they fast, they suffer nothing to enter their mouths, or other parts of their body, esteeming the fast broken and null, if they smell perfumes, take a clyster or injection, bathe, or even purposely swallow their spittle: some being so cautious, that they will not open their mouths to speak, lest they should breathe the air too freely: the fast is also deemed void, if a man kiss or touch a woman, or if he vomit designedly. But after sun-set they are allowed to refresh themselves, and to eat and drink, and enjoy the company of their wives till day-break; though the more rigid begin the fast again at midnight. This fast is extremely rigorous and mortifying when the month of Ramadan happens to fall in summer, (for, the Arabian year being lunar, each month runs through all the different seasons in the course of thirty-three years) the length and heat of the days making the observance of it much more difficult and uneasy than in winter.

The reason given why the month of Ramadan was pitched on for this purpose is, that on that month the Koran was sent down from heaven. Some pretend that Abraham, Moses, and Jesus, received their respective revelations in the same month.

The pilgrimage to Mecca is so necessary a point of practice, that, according to a tradition of Mohammed, he who dies without performing it may as well die a Jew or a Christian; and the same is expressly commanded in the Koran.

The temple of Mecca stands in the midst of the city, and is honoured with the title of Masjad al elharam, i. e. *the sacred or inviolable temple*. What is principally revered in this place, and gives sanctity to the whole, is a square stone building, called the Caaba, as some fancy, from its height, which surpasses that of the other buildings in Mecca; but more probably from its quadrangular form, and Beit Allah, i. e. *the house of God*, being peculiarly hallowed and set apart for his worship. The length of this edifice, from north to south, is twenty-four cubits, its breadth from east to west twenty-three cubits, and its height twenty-seven cubits: the door, which is on the east side, stands about four cubits from the ground; the floor being level with the bottom of the door. In the corner next this door is *the black stone*. On the north side of the Caaba, within a semicircular inclosure fifty cubits long, lies the *white stone*, said to be the sepulchre of Ishmael, which receives the rain water that falls off the Caaba by a spout, formerly of wood, but now of gold. The Caaba has a double roof, supported within by three octangular pillars of aloes wood; between which, on a bar of iron, hang some silver lamps. The outside is covered with rich black damask, adorned with an embroidered band of gold, which is changed every

year, and was formerly sent by the Khalifs, afterwards by the Soltans of Egypt, and is now provided by the Turkish emperors. At a small distance from the Caaba, on the east side, is the *station or place of Abraham*, where is another stone much respected by the Mohammedans, of which something will be said hereafter.

The Caaba, at some distance, is surrounded, but not entirely, by a circular inclosure of pillars joined towards the bottom by a low balustrade, and towards the top by bars of silver. Just without this inner inclosure, on the south, north, and west sides of the Caaba, are three buildings, which are the oratories or places where three of the orthodox sects assemble to perform their devotions, (the fourth sect, *viz.* that of al Shafei, making use of the station of Abraham for that purpose;) and, towards the south-east, stands the edifice which covers the well Zemzem, the treasury, and the cupola of al Abbas.

All these buildings are inclosed, at a considerable distance, by a magnificent piazza, or square colonnade, like that of the Royal Exchange in London, but much larger, covered with small domes or cupolas; from the four corners whereof rise as many minarets or steeples, with double galleries, and adorned with gilded spires and crescents, as are the cupolas which cover the piazza and the other buildings. Between the pillars of both inclosures hang a great number of lamps, which are constantly lighted at night.

This is properly all that is called the temple; but, the whole territory of Mecca being also Haram or sacred, there is a third inclosure distinguished at certain distances by small turrets, some five, some seven, and others ten miles distant from the city. Within this compass of ground it is not lawful to attack an enemy, or even to hunt or fowl, or cut a branch from a tree.

The temple of Mecca was a place of worship, and in singular veneration with the Arabs, from great antiquity, and many centuries before Mohammed. Though it was most probably dedicated at first to an idolatrous use, yet the Mohammedans are generally persuaded that the Caaba is almost coeval with the world.

After this edifice had undergone several reparations, it was a few years after the birth of Mohammed rebuilt by the Koreish on the old foundation, and afterwards repaired by Abd'allah Ebn Zobeir, the Khalif of Mecca; and at length again rebuilt by Yusof, surnamed al Hejaj, in the seventy-fourth year of the Hejra, with some alterations, in the form wherein it now remains. Some years after, however, the Khalif Harun al Rashid (or, as others write, his father al Mohdi, or his grandfather al Mansur) intended again to change what had been altered by al Hejaj, and to reduce the Caaba to the old form in which it was left by Abd'allah; but was dissuaded from meddling with it, lest so holy a place should become the sport of princes, and, being new-modelled after every one's fancy, should lose that reverence which was justly paid it. But; notwithstanding the antiquity and holiness of this building, they have a prophecy, by tradition from Mohammed, that in the last times the Ethiopians shall come and utterly demolish it; after which it will not be rebuilt again for ever.

Before we leave the temple of Mecca, two or three particulars

particulars deserve further notice. One is the celebrated *black stone*, which is set in silver, and fixed in the south-east corner of the Caaba, being that which looks toward Baſra, about two cubits and one third, or, which is the ſame thing, ſeven ſpans from the ground. This ſtone is exceedingly reſpected by the Mohammedans, and is kiſſed by the pilgrims with great devotion, being called by ſome the *right hand of God on earth*. They ſay, that it is one of the precious ſtones of paradise, and fell down to the earth with Adam, and, being taken up again, or otherwiſe preſerved at the deluge, the angel Gabriel afterwards brought it back to Abraham, when he was building the Caaba. It was at firſt whiter than milk, but grew black long ſince by the touch of a menſtruous woman, or, as others tell us, by the ſins of mankind, or rather by the touches and kiſſes of ſo many people; the ſuperficies only being black, and the inſide ſtill remaining white.

To this temple every Mohammedan, who has health and means ſufficient, ought once, at leaſt, in his life to go on pilgrimage; nor are women excuſed from the performance of this duty. The pilgrims meet at different places near Mecca, according to the different parts from whence they come, during the months of Shawal and Dhu'lkaada; being obliged to be there by the beginning of Dhu'lhajja; which month, as its name imports, is peculiarly ſet apart for the celebration of this ſolemnity.

At the place above-mentioned the pilgrims properly commence ſuch; when the men put on the Ithram or ſacred habit, which conſiſts only of two woollen wrappers, one wrapped about their middle to cover their privities, and the other thrown over their ſhoulders, having their heads bare, and a kind of ſlippers which cover neither the heel nor the inſole, and ſo enter the ſacred territory in their way to Mecca. While they have this habit on, they muſt neither hunt nor fowl, (though they are allowed to fiſh;) which precept is ſo punctually obſerved, that they will not kill even a louse or a flea, if they find them on their bodies: there are ſome noxious animals, however, which they have permission to kill during the pilgrimage, as kites, ravens, ſcorpions, mice, and dogs given to bite. During the pilgrimage, it behoves a man to have a conſtant guard over his words and actions, and to avoid all quarrelling or ill language, and all converſe with women and obſcene diſcourſe, and to apply his whole intention to the good work he is engaged in.

The pilgrims, being arrived at Mecca, immediately viſit the temple, and then enter on the performance of the preſcribed ceremonies which conſiſt chiefly in going in proceſſion round the Caaba, in running between the mounts Safa and Merwa, in making the ſtation on mount Arafat, and ſlaying the victims, and ſhaving their heads in the valley of Mina.

In compaſſing the Caaba, which they do ſeven times, beginning at the corner where the black ſtone is fixed, they uſe a ſhort quick pace the three firſt times they go round it, and a grave ordinary pace the four laſt; which, it is ſaid, was ordered by Mohammed, that his followers might ſhew themſelves ſtrong and active, to cut off the hopes of the infidels, who gave out, that the immoderate heats of Medina had rendered them weak. But the a-

foreſaid quick pace they are not obliged to uſe every time they perform this piece of devotion, but only at ſome particular times. So often as they paſs by the black ſtone, they either kiſs it, or touch it with their hand, and kiſs that.

The running between Safa and Merwa is alſo performed ſeven times, partly with a ſlow pace, and partly running; for they walk gravely till they come to a place between two pillars; and there they run, and afterwards walk again; ſometimes looking back, and ſometimes ſtopping, like one who has loſt ſomething, to repreſent Hagar ſeeking water for her ſon; for the ceremony is ſaid to be as ancient as her time.

On the ninth of Dhu'lhajja, after morning prayer, the pilgrims leave the valley of Mina, whither they come the day before, and proceed in a tumultuous and ruſhing manner to mount Arafat, where they ſtay to perform their devotions till ſun-ſet: then they go to Mozdalifa, an oratory between Arafat and Mina; and there ſpend the night in prayer, and reading the Koran. The next morning by day-break they viſit al Maſher al haram, or the *ſacred monument*, and, departing thence before ſun-riſe, haſte by Batn Mohaſſer to the valley of Mina, where they throw ſeven ſtones at three marks or pillars, in imitation of Abraham, who, meeting the devil in that place, and being by him diſturbed in his devotions, or tempted to diſobedience, when he was going to ſacrifice his ſon, was commanded by God to drive him away by throwing ſtones at him; though others pretend this rite to be as old as Adam, who alſo put the devil to flight in the ſame place and by the ſame means.

This ceremony being over, on the ſame day, the tenth of Dhu'lhajja, the pilgrims ſlay their victims in the ſaid valley of Mina; of which they and their friends eat part, and the reſt is given to the poor. Theſe victims muſt be either ſheep, goats, kine, or camels; males, if of either of the two former kinds; and females, if of either of the latter; and of a fit age. The ſacrifices being over, they ſhave their heads and cut their nails, burying them in the ſame place; after which the pilgrimage is looked on as completed; though they again viſit the Caaba, to take their leave of that ſacred building.

**MAIDEN**, an inſtrument uſed in Scotland for beheading criminals.

This is a broad piece of iron, about a foot ſquare, very ſharp on the lower part, and loaded above with a very heavy weight of lead. At the time of execution it is pulled up to the top of a narrow wooden frame, about ten feet high, and as broad as the engine, with mouldings on each ſide for the maiden to ſlide in. A convenience is made about four feet from the ground, for the priſoner to lay his neck; and there is a kind of bar ſo faſtened as to keep him from ſtirring. The priſoner being thus ſecured, and the ſign given, the maiden is let looſe, which in a moment ſeparates his head from his body.

**MAIDSTONE**, the county-town of Kent, ſituated on the Medway, twenty-two miles weſt of Canterbury: E. long 37', N. lat. 51° 20'. It ſends two members to parliament.

MAJESTY,

**MAJESTY**, a title given to kings, which frequently serves as a term of distinction.

Thus the emperor is called Sacred Majesty, Impérial Majesty, and Cæsarian Majesty; the king of France is called his Most Christian Majesty, and when he treats with the emperor, the word Sacred is added; and the king of Spain is termed his Most Catholic Majesty: with respect to other kings, the name of the kingdom is added, as his Britannic Majesty, his Polish Majesty, &c. Formerly princes were more sparing in giving titles, and more modest in claiming them; before the reign of Charles V. the kings of Spain had only the title of Highness; and before that of Henry VIII. the kings of England were only addressed under the title of Grace and Highness.

**MAIL**, or *coat of MAIL*, a piece of defensive armour for the body, made of small iron rings, interwoven in the manner of a net.

*Action of MAILES and Duties*, in Scots law. See **LAW**, Tit. xxx. 20.

**MAINE**, a river of Germany, which rises on the east side of the circle of Franconia, and running from east to west discharges itself into the Rhine at Mentz.

**MAINPRISE**, in law, is the receiving a person into friendly custody, who might otherwise be committed to prison, on security given that he shall be forthcoming at a certain time and place appointed.

**MAJOR**, in the art of war, the name of several officers of very different ranks and functions; as 1. Major-general, the next officer to the lieutenant general: his chief business is to receive the orders from the general, or in his absence from the lieutenant general of the day: which he is to distribute to the brigade-majors, with whom he is to regulate the guards, convoys, and detachments. When there are two attacks at a siege, he commands that on the left. He ought to be well acquainted with the strength of each brigade, of each regiment in particular, and to have a list of all the field officers. In short, he is in the army what a major is in a regiment. He is allowed an aid de camp, and has a serjeant and fifteen men for his guard. 2. Major of a brigade, the officer who receives the orders from the major-general, and afterwards delivers them to the adjutants of the regiments at the head of the brigade: where he takes and marches the detachments, &c. to the general rendezvous. He ought to be an expert captain, to know the state and condition of the brigade, and keep a roll of the colonels, lieutenant-colonels, majors, and adjutants. 3. Major of a regiment, the next officer to the lieutenant-colonel, generally promoted from the oldest captain. He is to take care that the regiment be well exercised, to see it march in good order, and to rally it in case of its being broke. He is the only officer among the foot that is allowed to be on horseback in time of action, that he may the more readily execute the colonel's orders, either in advancing or drawing off the regiment. 4. Major of a regiment of horse, is the first captain, who commands in the absence of the colonel. 5. Town-major, the third officer in a garrison, being next to the deputy-governor. He ought to understand fortification, and

hath charge of the guards, rounds, patrols, &c. His business is also to take care that the soldiers arms are in good order; he likewise orders the gates to be opened and shut, and gives the governor an account of all that passes within the place.

There are also aids major, drums-major, &c. so called from their preheinance above others of the same denomination.

**MAJOR**, in logic, the first proposition of a syllogism. See **LOGIC**.

**MAJORANA** in botany. See **ORIGANUM**.

**MAJORCA**, the capital of a Spanish island of the same name: E. long. 2° 30', N. lat. 39° 30'

This island is in the Mediterranean sea, about sixty miles long, and forty five broad, situated about eighty miles south of the coast of Catalonia, and an hundred miles east of Valencia.

**MAIRE**, or *streights of Le MAIRE*, is a passage to Cape Horn, situated between Terra del Fuego in South America, and Statten island; which being discovered by Le Maire, obtained his name.

**MAIZ**. See **ZEA**.

**MALA**, the cheek, in anatomy. See **ANATOMY**, p. 160.

**MALABAR**, the south west coast of the peninsula of hither India, about 400 miles long, and 100 broad, bounded by Visapour on the north; by the mountains of Baligate, on the east; and by the Indian ocean on the west and south.

**MALACCA**, the most southerly part of the further peninsula of India, about 600 miles long, and generally about 200 miles broad; bounded by Siam, on the north; by the bay of Siam and the Indian ocean, on the east; and by the streights of Malacca, on the south-west. The capital of this country, which is also commonly called Malacca, is situated in 100° of E. long. and 2° 30' N. lat.

**MALACHI**, or *the prophecy of MALACHI*, a canonical book of the old Testament, and the last of the twelve lesser prophets: Malachi prophesied about three hundred years before Christ, reproving the Jews for their wickedness after their return from Babylon, charging them with rebellion, sacrilege, adultery, prophaneness, and infidelity, and condemning the priests for being scandalously careless in their ministry: at the same time not forgetting to encourage the pious few, who, in that corrupt age, maintained their integrity. This prophet distinctly points at the Messiah, who was suddenly to come to his temple, and to be introduced by Elijah the prophet: that is, by John the Baptist, who came in the spirit and power of Elias or Elijah.

**MALACIA**, in medicine, is a languishing disorder incident to pregnant women, in which they long sometimes for one kind of food, and sometimes for another, and eat it with an extraordinary greediness.

**MALACOPTYGIOUS**, among ichthyologists, an appellation given to such fishes as have the rays of their fins bony, but not pointed or sharp at the extremities, like those of acanthopterygious fishes.

**MALACOSTOMOUS FISHES**, those destitute of teeth in the jaws, called in English leather-mouthed; as the tench, carp, bream, &c.

**MALAGA**, a city and port of Spain, in the province of Granada, situated in the Mediterranean, sixty-six miles north-east of Gibraltar: W. long.  $4^{\circ} 45'$ , N. lat.  $36^{\circ} 40'$ .

**MALAGMA**, a cataplasm. See **CATAPLASM**.

**MALAMOCCA**, a small island and port-town in the lagunes of Venice, situated five miles south of that city.

**MALDIVA-ISLANDS**, are about a thousand small islands in the Indian ocean, 500 miles south-west of the continent of the hither India, extending from the second degree of south latitude, to the seventh degree of north latitude.

**MALDON**, a port-town of Essex, ten miles east of Chelmsford. It sends two members to parliament.

**MALE**, among zoologists, that sex of animals which has the parts of generation without the body.

**MALIGNANT**, among physicians, a term applied to diseases of a very dangerous nature, and generally infectious: such are the dysentery, hospital-fever, &c. in their worst stages.

**MALL**, or **SEA-MALL**, in ornithology. See **LARUS**, **MALLEABLE**, a property of metals, whereby they are capable of being extended under the hammer.

**MALLEUS**, in anatomy. See **ANATOMY**, p. 297.

**MALLOW**, in botany. See **MALVA**.

**MALMSBURY**, a borough town of Wiltshire, thirty miles south-west of Salisbury: it sends two members to parliament.

**MALO**, or **St MALO**, a city and port-town of France, in the province of Brittany, situated on a rock, in the English channel, but joined to the continent by a causeway: W. long.  $2^{\circ}$ , N. lat.  $48^{\circ} 40'$ .

**MALOPE**, in botany, a genus of the monadelphia polyandria class. It has a double calix, the exterior one having three leaves; and the capsule contains but one seed. There is only one species, a native of Mauritania.

**MALPIGHIA**, in botany, a genus of the decandria trigynia class. The calix consists of five leaves, and the corolla of five roundish petals; and the berry has one cell and three seeds. There are nine species, none of them natives of Britain.

**MALPLAQUET**, a village in the Austrian Netherlands, in the province of Hainault, about seven miles from Mons.

**MALT**. See **BREWING**.

**MALTA**, the capital of a small island of the same name in the Mediterranean, is situated in E. long.  $15^{\circ}$ , N. lat.  $35^{\circ} 15'$ ; consisting of three towns, separated by channels, which form so many peninsulas of solid rock, rising a great height above the sea.

*Knights of MALTA*, otherwise called *Hospitalers of St. John of Jerusalem*, a religious military order, whose residence is in the island of Malta. The order consists of three estates, the knights, chaplains, and servants at arms: there are also priests who officiate in the churches; friar-sevants, who assist at the offices; and donnes, or demicrosses; but these are not reckoned constituent parts of the body. The government of the order is mixt, being partly monarchical, and partly aristocratical: the grand master is sovereign. The knights

formerly consisted of eight different languages, but now only seven, the English having withdrawn themselves. None are admitted into this order but such as are of noble birth: the knights are of two sorts, those who have a right to be candidates for the dignity of grand master, called grand crosses, and those who are only knights assistants: they never marry, yet have continued from 1090 to the present time. The knights are received into this order, either by undergoing the trials prescribed by statutes, or by dispensation.

**MALTON**, a borough of Yorkshire, situated on the river Derwent, twenty miles north-east of York. It sends two members to parliament.

**MALVA**, in botany, a genus of the monadelphia polyandria class. The calix is double, the exterior one consisting of three leaves; and there are many capsules, containing each one seed. There are 22 species, five of them natives of Britain, *viz.* the sylvestris, or common mallow; the rotundifolia, or dwarf mallow; the parvisflora, or small flowered mallow; the alcea, or vervain mallow; and the moschata, or jagged-leaved vervain mallow. The leaves of the mallow are emollient.

**MALUS**, in botany. See **PYRUS**.

**MAMALUKES**, the name of a dynasty that reigned in Egypt.

The Mamalukes were originally Turkish and Circassia slaves, bought of the Tartars by Melicfaleh, to the number of a thousand, whom he bred up to arms, and raised some to the principal offices of the empire. They killed sultan Moadam, to whom they succeeded.

Others say, that the mamalukes were ordinarily chosen from among the Christian slaves, and that they were the same thing in a great measure with the Janissaries among the Turks. They never married. They first are said to have been brought from Circassia, and some have supposed that they began to reign about the year 869.

**MAMMÆ**, in anatomy. See **ANATOMY**, p. 277.

**MAMMEA**, in botany, a genus of the polyandria monogynia class. The corolla consists of four petals, and the calix of two leaves; and the berry is large, and contains four seeds. There are two species, none of them natives of Britain.

**MAN**, in zoology. See **HOMO**.

**MANCHESER**, a large town of Lancashire, forty miles south-east of Lancaster.

**MANDAMUS**, in law, a writ that issues out of the court of king's bench, sent to a corporation, commanding them to admit or restore a person to his office.

**MANDARINS**, a name give to the magistrates and governors of provinces in China, who are chosen out of the most learned men, and whose government is always at a great distance from the place of their birth. Mandarin is also a name given by the Chinese to the learned language of the country; for besides the language peculiar to every province, there is one common to all the learned in the empire, which is in China what Latin is in Europe; this is called the mandarin tongue, or the language of the court.

**MANDATE**, in law, a judicial commandment to do something. See **MANDAMUS**.

**MANDATE**, in Scots law. See **LAW**, Tit. xxii. 9.

MAN-

**MANDERSCHEIT**, a city of Germany, in the electorate of Triers, and the capital of the county of Manderscheit: E. long.  $6^{\circ} 32'$ , N. lat.  $50^{\circ} 20'$ .

**MANDRAGORA**, in botany. See **ATROPA**.

**MANE**, the hair hanging down from a horse's neck; which should be long, thin, and fine; and if frizzled, so much the better.

**MANEGE**, or **MANAGE**, the exercise of riding the great horse, or the ground set apart for that purpose; which is sometimes covered, for continuing the exercise in bad weather; and sometimes open, in order to give more liberty and freedom both to the horse and rider. See **HORSEMANSHIP**.

**MANES**, in the pagan system of theology, a general name for the infernal deities, or gods of hell.

The ancients comprehended under manes not only Pluto, Proserpine, and Minos, but the souls likewise of the deceased were taken into the number, and esteemed gods of hell. It was usual to erect altars and offer libations to the manes of deceased friends and relations. One branch of the magic art among the pagans consisted in consulting the manes of the dead in matters of importance: this was called Necromancy. See **NECROMANCY**.

**MANGIFERA**, in botany, a genus of the pentandria monogynia class. The corolla consists of five petals; and the drupa is shaped like a kidney. There is but one species a native of Britain.

**MANHEIM**, a city of Germany, in the palatinate of the Rhine, situated at the confluence of the Rhine and Neckar: E. long.  $7^{\circ} 20'$ , N. lat.  $49^{\circ} 30'$ .

**MANIA**, in medicine. See **MEDICINE**.

**MANICHEES**, in church-history, a sect of Christian heretics in the third century, the followers of Manes, who made his appearance in the reign of the emperor Probus; pretending to be the comforter whom our Saviour promised to send into the world. He taught that there are two principles, or gods, coeternal and independent on each other, the one the author of all evil, and the other of all good; a doctrine which he borrowed from the Persian magi. He held that our souls were made by the good principle, and our bodies by the evil one; and that the souls of his followers passed through the elements to the moon, and from thence to the sun; where being purified, they then went to God, and became united with his essence; but as for the souls of other men, they either went to hell, or were united to other bodies. He alledged, that Christ had his residence in the sun, the Holy Ghost in the air, wisdom in the moon, and the Father in the abyss of light. He is also charged with denying the resurrection and condemning marriage; with teaching that Christ was the serpent that tempted Eve; with forbidding the use of eggs, cheese, milk, and wine, as proceeding from the bad principle; with using a different kind of baptism from that of the church; with teaching that magistrates were not to be obeyed; and with condemning the most lawful wars.

**MANICORDON**, or **MANICORD**, a musical instrument in the form of a spinet; the strings of which, like those of the clarichord, are covered with little pieces

of cloth, to deaden was well as to soften their sound; whence it is also called the dumb spinet.

**MANIFESTO**, a public declaration made by a prince in writing, shewing his intentions to begin a war, or other enterprise, with the motives that induce him to it, and the reasons on which he founds his rights and pretensions.

**MANILLE**, in commerce, a large brass-ring in the form of a bracelet, either plain or engraven, flat or round.

Manilles are the principal commodities which the Europeans carry to the coast of Africa, and exchange with the natives for slaves. These people wear them as ornaments on the small of the leg, and on the thick part of the arm above the elbow. The great men wear manilles of gold and silver, but these are made in the country by the natives themselves.

**MANIPULUS**, in Roman antiquity, a body of infantry, consisting of two hundred men, and constituting the third part of a cohort.

**MANIS**, the **SCALY LIZARD**, in zoology, a genus of quadrupeds, belonging to the order of Bruta, the characters of which are these: They have no fore-teeth either in the upper or under jaw; the tongue is long and cylindrical: the snout is long and narrow; and the body is covered with hard scales. There are two species, viz.

1. The pentadactyla, or scaly lizard with five toes on each foot. The head is smaller than the neck; the eyes are very small; the length of the body, including the tail, is from six to eight feet. The whole body is covered with hard scales, excepting the under part of the head and neck, the breast, the belly, and the internal side of each leg. Betwixt the scales of this animal, there are some hard hairs like the bristles of a hog, brownish at the points. The scales are of a reddish colour, very hard, convex above, and concave below. All the parts which want scales are naked. The scales are unconnected, and the animal can raise or lower them at pleasure like the quills of the porcupine. When irritated, he erects his scales, and rolls himself up like a hedge-hog. In this situation, neither the tiger, the lion, nor any other animal, is able to hurt him. This creature has nothing forbidding about him but his figure. He is mild and inoffensive, feeding on nothing but worms and other insects. His motion is slow; and he has no other method of escaping the pursuit of man, but by concealing himself in crannies of rocks, and in holes which they dig in the ground, where they likewise bring forth their young. This animal is a native of the East Indies; and are so few in number, that they are seldom to be met with.

2. The tetradactyla, or scaly lizard with four toes on each foot. This species is very similar to the former; only the tail is much longer in proportion to the body, and such parts as want scales, instead of being naked, are covered with a soft hair. It is likewise found in the East Indies. See **PLATE CIV** fig. 4.

**MANNA**, in the materia medica, the concreted juice of some vegetable, naturally exuding from it, soluble in water, and not inflammable.

It is a honey-like juice, brought to us from Calabria and

and Sicily, sometimes in small granules, or drops of an irregular figure, roundish, oblong, crooked, and sometimes contorted. It should be chosen whitish, or at the utmost with only a faint cast of yellow, not too heavy, in regular dry granules, or in moderately long striæ or flakes, of a pleasant taste, and dissolving wholly in the mouth, not leaving a farinacious substance behind it, as much of the common manna does that has been adulterated with honey and flour.

Manna is the mildest and safest of all purges, and may be given to children, to women with child and to people of the most tender constitutions, with perfect safety; and it never fails gently to move the bowels.

**MANOR**, an ancient royalty or lordship, formerly called a barony, consisting of demesnes, services, and a court-baron; and comprehending in it messuages, lands, meadow, pasture, wood, rents, an advowson, &c. It may contain one or more villages or hamlets, or only a great part of a village, &c.

**MANS**, the capital of the territory of Maine, in the province of Orleans in France: E. long. 5', N. lat. 48° 6'

**MANSFIELD**, a city of Germany, the capital of a county of the same name, in the circle of Upper Saxony: E. long. 11° 45'. N. lat. 51° 36'.

**MANSION**, in law, is the chief dwelling house of a lord within his fee, or the capital messuage or manor-house.

**MANSLAUGHTER**, generally termed homicide, is killing a person without premeditated malice.

**MANTELETS**, in the art of war, a kind of moveable parapets, made of planks about three inches thick, nailed one over another, to the height of almost six feet, generally cased with tin and set upon little wheels, so that in a siege they may be driven before the pioneers, and serve as blinds to shelter them from the enemy's small shot.

**MANTLE**, or **MANTLE TREE**, in architecture, the lower part of the chimney, or that piece of timber which is laid across the jaumbs, and sustains the compartment of the chimney piece.

**MANTLE**, or **MANTLING** in heraldry, that appearance of folding of cloth flourishing, or drapery, that is in any achievement drawn about the coat of arms. It is supposed originally to be the representation of a mantle, or military habit, worn by the ancient cavaliers over their armour to preserve it from rust: or, as others hold, a short covering only worn over the helmet, which in after-times was lengthened, and made to hang from the helmet below the whole shield. See Plate CX. fig. 1.

**MANTUA**, the capital of a duchy of the same name in Italy, is situated in the middle of a lake, formed by the river Mincio, but has a communication with the continent by three causeways: E. long. 11° 15', N. lat. 45° 20'.

**MANUMISSION**, in Roman antiquity, the act of setting a slave at liberty; which was usually performed before the prætor, who laid his wand called vindicta, on the slave's head, and declared him free.

**MANUFACTURER**, one who works up a natural product into an artificial commodity.

**MANURE**, any thing used for fattening and improving land. See AGRICULTURE, p. 47.

**MANUSCRIPT**, in matters of literature, denotes a written book, in contradistinction to a printed one. See Book.

**MAP**, a plain figure, representing the surface of the earth, or a part thereof, according to the laws of perspective. See GEOGRAPHY.

**MAPLE**, in botany. See ACER.

**MAPPARIUS**, in Roman antiquity, the officer who gave the signal to the gladiators to begin fighting; which he did by throwing an handkerchief that he had received from the emperor or other magistrate.

**MARANTA**, in botany, a genus of the monandria monogynia class. The corolla is ringent, and consists of five segments. There are two species, none of them natives of Britain.

**MARASMUS**, among physicians, denotes an atrophy or consumption, in its last and most deplorable stage.

**MARBLE** in natural history, a genus of fossils; being bright and beautiful stones, composed of small separate concretions, moderately hard, not giving fire with steel, fermenting with and soluble in acid menstrua, and calcining in a slight fire.

The colours of marbles being a very obvious and striking character, they are arranged according to them in the following divisions. 1. Of the white plain marbles there are two sorts; the Parian marble of the ancients, and Itatuary marble of the moderns, an extremely bright and elegant marble; and the Carara marble, a very fine marble, more compact and close than the former, but less bright. 2. Of the plain yellowish marbles there is only one sort, which is a hard, pale yellow, and glossy marble, found in many parts of Italy. 3. Of the bluish and black marbles there are a great many species, as the Chian marble, basaltes, &c. 4. Of the plain green marbles there is only one kind the Lacedemonian marble of the ancients. 5. The pale coloured or whitish brown, commonly called Darby-marble. 6. The green marbles with shells. 7. The black coralloide marble, with and without shells. 8. Of the white variegated marbles there are a great many species, variegated with purple, brown, red, blue, &c. 9. Of the brown variegated marbles there are likewise several sorts, some with red veins, others with white, black, or brown veins. 10. Of the yellow-veined and variegated marbles, some are veined with purple, and others with blue. 11. Of the black variegated marbles, some are veined with white, and others with blue, yellow, red, &c. 12. The green variegated marbles are likewise distinguished by the colour of their veins. 13. The gray spotted marbles are variegated, some with black, and others with green spots. 14. The red variegated marble is the brocatello of the Italians, with white and gold veins.

**Colouring of MARBLE**. The colouring of marbles is a nice art; and in order to succeed in it, the pieces of marble on which the experiments are tried must be well polished, and clear from the least spot or vein. The harder the marble is, the better it will bear the heat necessary in the operation; therefore alabaster, and

and the common soft white marble, are very improper to perform these operations upon.

Heat is always necessary for the opening the pores of the marble, so as to render it fit to receive the colours: but it must never be made red hot; for then the texture of the marble itself is injured, and the colours are burnt, and lose their beauty. Too small a degree of heat is as bad as too great; for, in this case tho' the marble receive the colour, it will not be fixed in it, nor strike deep enough. Some colours will strike, even cold; but they are never so well sunk in as when a just degree of heat is used. The proper degree is that which, without making the marble red, will make the liquor boil upon its surface. The menstrua used to strike in the colours must be varied according to the nature of the colour to be used. Alixivium made with horse's or dog's urine, with four parts quick lime, and one part pot ashes, is excellent for some colours; common lye of wood-ashes does very well for others: for some, spirit of wine is best; and finally, for others, oily liquors, or common white-wine

The colours which have been found to succeed best with the peculiar menstrua, are these: stone blue dissolved in six times the quantity of spirit of wine, or of the urinous lixivium; and that colour which the painters call Firmous, dissolved in common lye of wood-ashes. An extract of saffron, and that colour which the painters call kthorn-berries, and called by the painters sapphire-green, both succeed well dissolved in urine and quicklime and tolerably well in spirit of wine. Vermilion, and a fine powder of cochineal, succeed also very well in the same liquors. Dragon's blood succeeds very well in spirit of wine, as does also a tincture of logwood in the same spirit. Alkanet root gives a fine colour, but the only menstruum to be used for this is oil of turpentine; for neither spirit of wine, nor any lixivium, will do with it. There is another kind of sanguis draconis, called dragon's blood in tears, which, mixed with urine alone, gives a very elegant colour. Besides these mixtures of colours and menstrua, there are some colours which are to be laid on dry and unmixed. These are dragon's blood, of the purest kind, for a red; gamboge for a yellow; green wax for a green; common brimstone, pitch, and turpentine, for a brown colour. The marble, for these experiments, must be made considerably hot, and then the colours are to be rubbed on dry in the lump. Some of these colours, when once given, remain immutable; others are easily changed or destroyed. Thus the red colour given by dragon's blood, or by a decoction of logwood, will be wholly taken away by oil of tartar, and the polish of the marble not hurt by it.

A fine gold colour is given in the following manner: take crude sal armoniac, vitriol, and verdegrease, of each equal quantities; white vitriol succeeds best; and all must be thoroughly mixed in fine powder.

The staining of marble to all the degrees of red or yellow, by solutions of dragon's blood or gamboge, may be done by reducing these gums to powder, and grinding them, with the spirit of wine, in a glass mortar; but for smaller attempts, no method is so good,

as the mixing a little of either of these powders with spirit of wine in a silver spoon, and holding it over burning charcoal. By this means a fine tincture will be extracted; and with a pencil dipped in this, the finest traces may be made on the marble while cold, which, on the heating it afterwards either on sand, or in a baker's oven, will all sink very deep, and remain perfectly distinct in the stone. It is very easy to make the ground colour of the marble red or yellow by this means and leave white veins in it. This is to be done by covering the places where the whiteness is to remain with some white paint, or even with two or three doubles only of paper, either of which will prevent the colour from penetrating in that part. All the degrees of red are to be given to marble by means of this gum alone; a slight tincture of it, without the assistance of heat to the marble, gives only a pale flesh colour, but the stronger tinctures give it yet deeper; to this the assistance of heat adds yet greatly; and finally, the addition of a little pitch to the tincture gives it a tendency to blackness, or any degree of deep red that is desired. A blue colour may be given also to marble by dissolving turpentine in a lixivium of lime and urine, or in the volatile spirit of urine; but this has always a tendency to purple, whether made by the one or the other of these ways. A better blue, and used in an easier manner, is furnished by the Canary turnsole, a substance well known among the dyers; this needs only to be dissolved in water, and drawn on the place with a pencil: this penetrates very deep into the marble, and the colour may be increased by drawing the pencil wetted afresh several times over the same lines. This colour is subject to spread and diffuse itself irregularly; but it may be kept in regular bounds, by circumscribing its lines with beds of wax, or any other such substance.

*Polishing of MARBLES* is performed by first rubbing them well with a free stone, or sand till the strokes of the axe are worn off, then with pumice stone, and afterwards with emery.

*Arundel-MARBLES*, ancient marbles with a chronicle of the city of Athens inscribed on them, many years before our Saviour's birth; presented to the university of Oxford by Thomas earl of Arundel, whence the name. *MARBLING*, in general, the painting any thing with veins and clouds, so as to represent those of marble.

Marbling of books or paper is performed thus: Dissolve four ounces of gum arabic into two quarts of fair water; then provide several colours mixed with water in pots or shells, and with pencils peculiar to each colour, sprinkle them by way of intermixture upon the gum-water, which must be put into a trough or some broad vessel; then with a stick curl them, or draw them out in streaks, to as much variety as may be done. Having done this, hold your book or books close together, and only dip the edges in, on the top of the water and colours very lightly; which done, take them off, and the plain impression of the colours in mixture will be upon the leaves; doing as well the ends as the front of the book in the like manner.

After the same manner you may make marbled paper,

per, by dipping it on the flat, as also linnen cloth, &c.

Marbling a book on the covers is performed by forming clouds with aqua fortis, or spirit of vitriol mixed with ink, and afterwards glazing the covers.

**MARCASITES**, in natural history, are defined to be compound inflammable metallic bodies, of a hard and solid substance, of an obscurely and irregularly foliaceous structure, of a bright glittering appearance, naturally constituting whole strata, though sometimes found in detached masses; very freely giving fire with steel; not fermenting with acid menstrooms; and when put into the fire, yielding a blue sulphureous flame, and afterwards calcining into a purple powder. There are only three known species of this genus: 1. The silver-coloured marcasite, found in vast abundance in lead and tin mines. 2. The gold coloured marcasite. 3. The heavy pale-white marcasite.

Marcasites were at first supposed to be almost all pure gold or silver, according to their colour; but experience has shewn, that if they contain any metal at all, no method has hitherto been found of working them to advantage. In Germany, indeed, they extract sulphur and vitriol from the silver marcasite, which two substances are always contained in it; and besides these, it has usually a quantity of arsenic. It has been recommended as a styptic, after being calcined: but as the arsenic may not be all carried off by that operation, its use as a medicine seems extremely dangerous.

**MARCGRAVE**, or **MARGRAVE**, a degree of honour in Germany answering to our marquis.

**MARCGRAVIA**, in botany, a genus of the polyandria monogynia class. The corolla consists of one petal, and the calix consists of six imbricated leaves; and the berry has one cell, containing many seeds. There is but one species, a native of America.

**MARCH**, in chronology, the third month of the year, consisting of thirty-one days.

**MARCHANTIA**, in botany, a genus of the cryptogamia algæ class. The calix of the male is peltated, and covered below with monopetalous corollæ; the calix of the female is sessile, bell-shaped, and contains many seeds. There are eight species, four of them natives of Britain, viz. the polymorphia, or common marchantia; the cruciata, or cross-headed marchantia; the hemisphærica, or marsh marchantia; and the conica, or wart marchantia.

**MARCHE**, a territory of Lyonois, in France, having Berry on the north, Burbonois and Auvergne on the east, Limosin on the south, and Poictou on the west.

**MARCHPURG**, a town of Germany, in the circle of Austria and duchy of Stîria: W. long. 15° 50', N. lat. 47°.

**MARCIONITES**, Christian heretics in the II<sup>d</sup> century, thus denominated from their leader Marcion, who maintained, that there were two principles or gods, a good and a bad one.

**MARCOSIANS**, a sect of Christian heretics in the II<sup>d</sup> century, so called from their leader Marcus, who represented the supreme God as consisting not of a trini-

ty, but a quaternity, viz. the ineffable, silence, the father, and truth.

**MARE**, the female of the horse kind. See **EQUUS**.

**MARGARETTA**, one of the largest of the Leeward-islands; it is about fifty miles long, and twenty-four broad, and situated fifty miles north of the continent of Paria, or New Andalusia, in South America: W. long. 64°, and N. lat. 11° 30'.

**MARGARITA**, the **PEARL**, in natural history. See **PEARL**.

**MARGATE**, a port-town of Kent, in the isle of Thanet, 12 miles north of Deal.

**MARIGNAN**, a city and port-town of Brazil, the capital of the captainship of Marignan, situated at the mouth of the river St Mary: W. lon. 44°, and S. lat. 2° 15'.

**MARINER**, the same with sailor. See **SAILOR**.

**MARINO**, a city of Italy, in the duchy of Urbino, the capital of the territory of Marino, a little state or commonwealth, situated on a mountain in the middle of the Pope's territories: E. long. 13° 30', and N. lat. 44°.

**MARJORAM**, in botany. See **ORIGANUM**.

**MARITIME**, something related to, or bounded by the sea: thus, a maritime province, or country, is one bounded by the sea; and a maritime kingdom, or state, is one that makes a considerable figure, or is very powerful at sea. Hence, by maritime powers, among the European states, are understood Great Britain and Holland.

*St MARK the evangelist's day*, a festival of the Christian church, observed April 25.

*St MARK's Gospel*, a canonical book of the New Testament, being one of the four gospels.

St Mark wrote his gospel at Rome, where he accompanied St Peter, in the year of Christ 44. Tertullian and others pretend that St Mark was no more than an amanuensis to St Peter, who dictated this gospel to him; others affirm, that he wrote it after St Peter's death. Nor are the learned less divided as to the language this gospel was wrote in; some affirming it was composed in Greek, others in Latin. Several of the ancient heretics received only the gospel of St Mark: others among the catholics rejected the twelve last verses of this gospel. The gospel of St Mark is properly an abridgment of that of St Matthew.

*Canons of St MARK*, a congregation of regular canons, founded at Mantua, by Albert Spinola a priest, towards the end of the XII<sup>th</sup> century. Spinola made a rule for them, which was approved, corrected, and confirmed by several succeeding popes. About the year 1450, they were reformed, and followed only the rule of St Augustine. This congregation having flourished for the space of four hundred years, declined by little and little, and is now become extinct.

*Knights of St MARK*, an order of knighthood in the republic of Venice, under the protection of St Mark the evangelist. The arms of the order are, gules, a lion winged, or, with this device, **PAX TIBI MARCE EVANGELISTA**. This order is never conferred but on those

those who have done signal service to the commonwealth. **MARK**, or **MARC**, also denotes a weight used in several states of Europe, and for several commodities, especially gold and silver. In France, the mark is divided into 8 ounces, or 64 drachms, or 192 deniers or penny weights, or 160 esterlines, or 300 maills, or 640 felins, or 4608 grains. In Holland the mark-weight is also called troy weight, and is equal to that of France. When gold and silver are sold by the mark, it is divided into 25 carats.

**MARK** is also used among us for a money of account, and in some other countries for a coin.

The English mark is two thirds of a pound sterling, or 13s. 4d. and the Scotch mark is of equal value in Scotch money of account.

**MARKET**, a public place in a city or town, in which live cattle, provisions, or other goods, are set to sale; and also a privilege, either by grant or prescription, by which a town is enabled to keep a market.

**MARLBRO**, or **MARLBOROUGH**, a borough-town of Wiltshire, eighteen miles north of Salisbury.

It sends two members to parliament.

**MARLBRO-FORT**, an English factory on the west coast of the island of Sumatra, three miles east of Bencoolen: E. long. 101°, and S. lat. 4° 15'.

**MARLE**. See **AGRICULTURE**, p. 48.

**MARLOW**, a borough town of Buckinghamshire, fifteen miles south of Aylesbury. It sends two members to parliament.

**MARMALADE**, a confection of plumbs, apricots, quinces, &c. boiled with sugar to a consistence.

**MARMOR**. See **MARBLE**.

**MARMORA**, a little island of Turkey, situated in the sea of Marmora, to which it gives name, lying sixty miles south-west of Constantinople.

**MARMOTTE**, in zoology. See **MUS**.

**MAROSCH**, or **MERISH**, a great river, which, rising in the Carpathian mountains, runs through Transilvania and Hungary, and falls into the river Teyse at Segedin.

**MARPURG**, a city of Germany, forty miles north of Frankfurt: E. long. 8°, 40', and N. lat. 50° 40'.

**MARQUE**, or *letters of MARQUE*, in military affairs, are letters of reprisal, granting the subjects of one prince or state liberty to make reprisals on those of another.

Letters of marque among us, are extraordinary commissions granted by authority for reparation to merchants, taken and spoiled by strangers at sea; and reprisals is only the retaking, or taking of one thing for another.

**MARQUETRY**, or **INLAID-WORK**, is a curious work composed of several fine hard pieces of wood, of various colours, fastened in thin slices on a ground, and sometimes enriched with other matters, as silver, brass, tortoise-shell, and ivory: with these assistances the art is now capable of imitating any thing; whence it is by some called the art of painting in wood.

**MARQUIS**, a title of honour, next in dignity to that of duke, first given to those who commanded the marches, that is, the borders and frontiers of countries.

**MARR**, that part of Aberdeenshire situated between the rivers Dee and Don.

**MARRIAGE**, a contract both civil and religious, between a man and a woman, by which they engage to live together in mutual love and friendship, for the ends of procreation, &c. See **LAW**, Tit. vi.

The Romans, as well as the Greeks, disallowed of polygamy. A Roman might not marry any woman who was not a Roman. It was thought dishonourable for a woman to marry twice.

We find but few laws in the books of Moses concerning the institution of marriage: he restrained the Israelites from marrying within certain degrees of consanguinity; but we find, that polygamy, though not expressly allowed, is however tacitly implied in the laws of Moses: there is a particular law that obliged a man, whose brother died without issue, to marry his widow, and raise up children to his brother. The Hebrews purchased their wives, by paying down a competent dowry for them; and a man was at liberty to marry, not only in any of the twelve tribes, but even out of them, provided it was with such nations as used circumcision.

The ancient Christian church laid several restraints upon her members in relation to marriage; such was the rule forbidding Christians to marry with infidels and heathens: another restraint related to the consanguinity and affinity prohibited in scripture: a third was, that children under age should not marry without the consent of their parents, guardians, or next relations: and another was, that there should be some parity of condition between the contracting parties. They not only condemned polygamy, but even reckoned it unlawful to marry after a divorce. The Romish church requires of the clergy perpetual abstinence from marriage; and has advanced this institution to the dignity of a sacrament.

**MARROW**, in anatomy, a soft oleaginous substance contained in the cavity of the bones. See **ANATOMY**, p. 147.

**MARRUBIUM**, in botany, a genus of the didynamia gymnospermia class. The calix is rigid, with ten streaks; and the upper lip of the corolla is bifid, linear, and erect. There are nine species, only one of them, viz. the vulgare, or white horehound, is a native of Britain.

**MARS**, in astronomy. See **ASTRONOMY**, p. 441.

**MARS**, among chemists, denotes iron, as being supposed to be under the influence of that planet. See **CHEMISTRY**, p. 82 and 133.

**MARSEILLES**, a city and port of Provence, situated on a fine bay of the Mediterranean, twenty five miles north-west of Toulon: E. long 5° 20', N. lat 43° 15'.

**MARSHAL**, in its primary signification, means an officer who has the command or care of horses; but it is now applied to officers who have very different employments, as earl marshal, knight marshal, or marshal of the king's house, &c.

**MARSHAL of the king's bench**, an officer who has the custody of the king's-bench-prison in Southwark. This officer is obliged to give his attendance, and to take

take into his custody all persons committed by that court

**MARSHAL** of the *exchequer*, an officer to whom that court commits the king's debts.

**MARSHAL** of the *king's hall*, an officer who has the care of placing the household servants and strangers at table, according to their quality.

**MARSHAL**, or **MARESCHAL**, of France, an officer of the greatest dignity in the French armies. When two or more marshals are in the army, the eldest commands.

**MARSHALLING** a coat, in heraldry, is the disposal of several coats of arms belonging to distinct families, in one and the same escutcheon or shield, together with their ornaments, parts, and appurtenances.

**MARSHFIELD**, a market-town of Wiltshire, thirty-miles north-west of Salisbury.

**MARSHMALLOW**, in botany. See **ALTHÆA**.

**MARSILEA**, in botany, a genus of the cryptogamia class. The antheræ are four, and placed on an obtusely conic body: the fruit is of a roundish figure, consisting of four cells, in each of which are contained several roundish seeds. There are two species, none of them natives of Britain

*St* **MARTHA**, a city and port-town of Terra Firma, in South America, and the capital of the province of St Martha: W. long. 74° 30'. N. lat. 11° 45'.

**MARTIAL LAW**, is the law of war, which entirely depends on the arbitrary power of the prince, or of those to whom he has delegated it. For though the king can make no laws in time of peace without the consent of parliament, yet in time of war he uses an absolute power over the army.

**MARTIN**. in zoology. See **MUSTELA**.

*Cape* **MARTIN**, a promontory of Valencia, in Spain, on the Mediterranean: it is under the meridian of London: N. lat. 38° 50'.

**MARTINGALE**, in the manege, a thong of leather, fastened to one end of the girths under the belly of a horse, and at the other end to the mule's roll, to keep him from rearing.

**MARTINICO**, the chief of the French Caribbee-islands, situated in 61° of west long. and between 14° and 15° N. lat. It is sixty miles long, but is scarce twenty broad in any part

**MARTLETS**, in heraldry, little birds represented without feet, and used as a difference or mark of distinction for younger brothers, to put them in mind that they are to trust to the wings of virtue and merit, in order to raise themselves, and not their feet, they having little land to set their foot on. See Plate CX fig. 2.

**MARTYNIA**, in botany, a genus of the didynamia angiospermia class. The calix consists of five segments; the corolla is ringent; and the capsule is woody, with a hooked beak, two valves, and three cells. There are two species, both natives of America.

**MARTYR**, is one who lays down his life or suffers death for the sake of his religion.

**MARTYROLOGY**, is a catalogue or list of martyrs, including the history of their lives and sufferings for the sake of religion.

The martyrologies draw their materials from the kalendars of particular churches, in which the several festivals dedicated to them are marked; and which seem to be derived from the practice of the ancient Romans, who inserted the names of heroes and great men in their fasts, or public registers.

The martyrologies are very numerous, and contain many ridiculous and even contradictory narratives; which is easily accounted for, if we consider how many forged and spurious accounts of the lives of saints and martyrs appeared in the first ages of the church, which the legendary writers afterwards adopted without examining into the truth of them. However, some good critics, of late years, have gone a great way towards clearing the lives of the saints and martyrs from the monstrous heap of fiction they laboured under.

**MARVEL** of Peru, in botany. See **MIRABILIS**.

**MARY MAGDALEN'S DAY**, a festival of the Romish church, observed on the twenty-second of July.

**MARYGOLD**. See **CALTHA**.

*Corn* **MARYGOLD**. See **CHRYSANTHEMUM**.

*French* **MARYGOLD**, in botany. See **TAGETES**.

**MARYLAND**, one of the British plantations in North America, situated between 74° and 78° W. long. and between 38° and 40° N. lat.

**MASCULINE**, or **MASCULINE GENDER**, among grammarians, that belonging to the male. See **GRAMMAR**.

**MASHAM**, a market town of Yorkshire, situated twenty-four miles north west of the city of York.

**MASK**. See **MASQUE**.

**MASON**, a person employed, under the direction of an architect, in raising of a stone-building

*Free and accepted* **MASONS**, a very ancient society or body of men, so called, either from some extraordinary knowledge of masonry or building, which they are supposed to be masters of, or because the first founders of the society were persons of that profession. These are now very considerable, both for number and character, being found in every country in Europe, and consisting principally of persons of merit and consideration. As to antiquity, they lay claim to a standing of some thousand years. What the end of their institution is, seems still in some measure a secret; and they are said to be admitted into the fraternity by being put in possession of a great number of secrets, called the mason's word, which have been religiously kept from age to age, being never divulged.

**MASONRY**, in general, a branch of architecture, consisting in the art of hewing or squaring stones, and cutting them level or perpendicular, for the uses of building: but, in a more limited sense, masonry is the art of assembling and joining stones together with mortar. See **ARCHITECTURE**.

**MASS**, in the church of Rome, the office or prayers used at the celebration of the eucharist; or, in other words, consecrating the bread and wine into the body and blood of Christ, and offering them, so transubstantiated, as an expiatory sacrifice for the quick and the dead. As the mass is in general believed to be a representation of the passion of our blessed Saviour, so every

every action of the priest, and every particular part of the service, is supposed to allude to the particular circumstances of his passion and death.

The general division of masses consists in high and low. The first is that sung by the choristers, and celebrated with the assistance of a deacon and sub-deacon: low masses are those in which the prayers are barely rehearsed without singing.

There are a great number of different or occasional masses in the Romish church, many of which have nothing peculiar but the name: such are the masses of the saints; that of St Mary of the snow, celebrated on the fifth of August; that of St Margaret, patroness of lying-in women; that of the feast of St John the Baptist, at which are said three masses; that of the Innocents, at which the gloria in excelsis and the hallelujah are omitted, and it being a day of mourning the altar is of a violet colour. As to ordinary masses, some are said for the dead, and, it is supposed, contribute to fetch the soul out of purgatory. At these masses the altar is put in mourning, and the only decorations are a cross in the midst of six yellow wax-lights: the dress of the celebrant and the very mass-book are black: many parts of the office are omitted, and the people are dismissed without the benediction. If the mass be said for a person distinguished by his rank or virtues, it is followed with a funeral oration: they erect a chapelle ardente, that is, a representation of the deceased, with branches and tapers of yellow wax, either in the middle of the church, or near the deceased's tomb, where the priest pronounces a solemn absolution of the deceased. There are likewise private masses, said for stolen or strayed goods or cattle; for health; for travellers, &c. which go under the name of votive masses. There is still a further distinction of masses denominated from the countries in which they were used; thus the Gothic mass, or missa mosarabum, is that used among the Goths when they were masters of Spain, and which is still kept up at Toledo and Salamanca; the Ambrosian mass is that composed by St Ambrose, and used only at Milan, of which city he was bishop; the Gallic mass, used by the ancient Gauls; and the Roman mass, used by almost all the churches in the Romish communion.

MASSA, the capital of the duchy of Massa Carara, in Italy, situated between the territories of Lucca and Genoa: E. long. 10° 40', N. lat 43° 55'.

MASSACHUSETT-COLONY, the principal sub-division of New-England, is bounded by New-Hampshire, on the north; by the Atlantic ocean, on the east and south; and by Connecticut and New York, on the west. It is about 100 miles long, and 40 broad.

MASSALIANS, a set of enthusiasts who sprang up about the year 361, in the reign of the emperor Constantius, who maintained that men have two souls, a celestial and a diabolical, and that the latter is driven out by prayer.

MASSETER, in anatomy. See ANATOMY, p. 221.

MASSORA, in matters of literature, a critical work, containing remarks on the verses, words, letters, and vowel-points of the Hebrew text of the bible; a work more laborious than useful.

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MAST, in naval architecture, a large timber in a ship, for sustaining the yards, sails, &c.

In large vessels there are four masts, viz. the main-mast, fore-mast, mizen-mast, and bowsprit. See SHIP-BUILDING.

MASTER, in general, is a title of authority; as, the grand master of Malta, the master of St Lazarus, &c.

The Romans had a great many officers thus denominated; as, the master of the people, or dictator; the master of the cavalry, foot, census, &c.

MASTER of arts, is the first degree taken up in universities.

MASTERS in chancery, in ordinary, of which there are twelve, the master of the rolls being chief, are usually chosen out of the barristers of the common law, and sit in chancery, or at the rolls, as assistants to the lord chancellor and master of the rolls.

MASTER of the horse, a great officer of the crown, who orders all matters relating to the king's stables, races, breed of horses; and commands the equerries and all the other officers and tradesmen employed in the king's stables. His coaches, horses, and attendants are the king's, and bear the king's arms and livery.

MASTER of the revels, an officer who orders all things relating to the performance of plays, masks, balls, &c. at court.

MASTER of the rolls, a patent officer for life, who has the custody of the rolls of parliament and patents which pass the great-seal, and of the records of chancery, as also commissions, deeds, recognizances, which, being made of rolls of parchment, gave rise to the name.

In absence of the chancellor, he sits as judge in the court of chancery: at other times, he hears causes in the rolls chapel, and makes orders; but all hearings before him are appealable to the chancellor.

MASTER of the wardrobe, an officer under the lord chamberlain, who has the care of the royal robes, as well as the wearing apparel, collar, george, and garter, &c. He has also the charge of all former kings and queens robes remaining in the Tower, all hangings, bedding, &c. for the king's house, the charge and delivery of velvet and scarlet allowed for liveries. He has under him a clerk of the robes, wardrobe-keeper, a yeoman, &c.

MASTER WORT, in botany. See IMPERATORIA.

MASTICATION, the action of chewing, or of agitating the solid parts of our food between the teeth, by means of the motion of the jaws, the tongue, and the lips, whereby it is broken into small pieces, impregnated with saliva, and so fitted for deglutition and a more easy digestion.

MASTICH, in the materia medica, a solid resin, of a pale, yellow, white colour, brought to us principally from the island of Chios, in drops or tears as it naturally forms itself in exuding from the tree, about the bigness and much in the form of a pea. It is to be chosen clear, pellucid, and of a pale yellowish colour, well scented, and brittle. We meet with a kind of cement sometimes kept in the shops under the name of mastich. It is composed of mastich, and several other ingredients, and is formed into cakes for use. This is intended for the service of the lapidaries, to fill up cracks in stones, and for other such purposes:

but is by no means to be used as mastic for any of the medicinal purposes.

Mastic is detergent, astringent, and stomachic; it is greatly recommended in inveterate coughs and against spitting of blood. It strengthens the stomach, assists digestion, and stops vomiting.

**MASTIGADOUR**, or **SLABBERING-BIT**, in the manege, a snaffle of iron, all smooth, and of a piece, guarded with pate nozzers, and composed of three halves of great rings, made into demi-ovals, of unequal big-ness; the lesser being inclosed within the greater, which ought to be about half a foot high.

**MASULIPATAN**, a city and port town of the hither India: E. long. 81°. and N. lat. 16° 18'.

**MATAMAN**, a country in the south-west of Africa, bounded by Benguelo, on the north; by Manomotapa, on the east, by Caffraria, on the south; and by the Atlantic ocean, on the west.

**MATAPAN CAPE**, in the Morea, the southmost promontory of Europe, situated in E. long. 22°, N. lat. 26°.

**MATCH**, a kind of rope slightly twisted, and prepared to retain fire for the uses of artillery, mines, fireworks, &c.

It is made of hempen tow, spun on the wheel like cord, but very slack; and is composed of three twits, which are afterwards again covered with tow, so that the twits do not appear: lastly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually and regularly, without ever going out, till the whole be consumed: the hardest and driest match is generally the best.

**MATCHING**, in the wine trade, the preparing vessels to preserve wines and other liquors, without their growing sour or vapid. The method of doing it, is as follows: melt brimstone in an iron ladle, and when thoroughly melted, dip into it slips of coarse linen-cloth; take these out, and let them cool: this the wine coopers call a match; take one of these matches, set one end of it on fire, and put it into the bung-hole of a cask; stop it loosely and thus suffer the match to burn nearly out: then drive in the bung tight, and set the cask aside for an hour or two. At the end of this time examine the cask, and you will find that the sulphur has communicated a violent purgent and suffocating scent to the cask, with a considerable degree of acidity, which is the gas and acid spirit of the sulphur. The cask may after this be filled with a small wine, which has scarce done its fermentation; and bunging it down tight, it will be kept good. and will soon clarify: this is a common and very useful method; for many poor wines could scarce be kept potable even a few months without it.

**Dura MATER**. See **ANATOMY**, p. 284.

**Pia MATER**. See **ANATOMY**, p. 285.

**MATERAN**, the capital of a kingdom of the same name, situated on the south coast of the island of Java. This city is said to lie in E. long. 110°, S. lat. 7° 45'.

**MATERIA SUBTILIS**, denotes a fine subtle matter, which the Cartesians suppose to pervade and penetrate freely the pores of all bodies, to fill up all their pores so as not to leave the least vacuity or interstice between them: they had recourse to this machine to support

the doctrine of an absolute plenum, and to make it consistent with the phenomenon of motion, &c.

**MATERIA MEDICA**, comprehends all the substances either used in medicine in their natural state, or which afford preparations that are so; these belong partly to the animal, partly to the vegetable, and partly to the fossil kingdom.

The preparations and virtues of all which are delivered under their respective articles, but in as concise and scrupulous a manner as we possibly could; since we cannot but remark, that it is too frequent in writers on the materia medica, to give us rather encomiums than impartial accounts of the simples they treat of.

**MATHEMATICS**, originally signified any discipline or learning; but, at present, denotes that science which teaches, or contemplates, whatever is capable of being numbered or measured, in so far as computable or measurable; and accordingly is subdivided into Arithmetic, which has numbers for its object, and Geometry, which treats of magnitude. See **ARITHMETICK** and **GEOMETRY**.

Mathematics are commonly distinguished into pure and speculative, which consider quantity abstractedly; and mixed, which treat of magnitude as subsisting in material bodies, and consequently are interwoven every where with physical considerations.

Mixed mathematics are very comprehensive; since to them may be referred Astronomy, Optics; Geography, Hydrostatics, Mechanics, Fortification, Navigation, &c. See the articles **ASTRONOMY**, **OPTICS**, &c.

Pure mathematics have one peculiar advantage, that they occasion no disputes among wrangling disputants, as in other branches of knowledge; and the reason is, because the definitions of the terms are premised, and every body that reads a proposition has the same idea of every part of it. Hence it is easy to put an end to all mathematical controversies, by shewing either that our adversary has not stuck to his definitions, or has not laid down true premises, or else that he has drawn false conclusions from true principles; and in case we are able to do neither of these, we must acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reason mathematically upon physical subjects, we cannot give such just definitions as the geometers: we must therefore rest content with descriptions, and they will be of the same use as definitions, provided we are consistent with ourselves, and always mean the same thing by those terms we have once explained.

Dr. Barrow gives a most elegant description of the excellence and usefulness of mathematical knowledge, in his inaugural oration, upon being appointed professor of mathematics at Cambridge.

The mathematics, he observes, effectually exercise, not vainly delude, nor vexatiously torment, studious minds with obscure subtilties; but plainly demonstrate every thing within their reach, draw certain conclusions, instruct by profitable rules, and unfold pleasant questions. These disciplines likewise enure and corroborate the mind to a constant diligence in study; they wholly deliver us from a credulous simplicity, most strongly fortify us against the vanity of scepticism, effectual

fectually restrain us from a rash presumption, most easily incline us to a due assent, perfectly subject us to the government of right reason. While the mind is abstracted and elevated from sensible matter, distinctly views pure forms, conceives the beauty of ideas, and investigates the harmony of proportions. The manners themselves are sensibly corrected and improved, the affections composed and rectified, the fancy calmed and settled, and the understanding raised and excited to more divine contemplations.

**MATRASS, CUCURBIT, or BOLT-HEAD,** among chemists. See **CHEMISTRY**, p. 109.

**MATRICARIA**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is naked; it has, no pappus; the calix is hemispherical, and imbricated, with sharp solid margins. There are five species, all of them natives of Britain, *viz.* The parthenium, or feverfew, which is reckoned good in hysterical cases, the chamomilla, or corn-feverfew, the flowers of which are stomachic; the suaveolens, or sweet-scented feverfew; the inodora, or field feverfew; and the maritima, or sea feverfew.

**MATRICULA**, a register kept of the admission of officers and persons entered into any body or society, whereof a list is made.

**MATRIX**, in anatomy. See **ANATOMY**, p. 274.

**MATRONALIA**, a festival of the ancient Roman matrons, from whom it has its name. It was celebrated on the kalends of March in honour of the god Mars; and was to the Roman ladies what the festival of the Saturnalia was to their husbands; for at this time they served their women slaves at tables, and received presents from their husbands. See **SATURNALIA**.

**MATROSES**, are soldiers in the train of artillery, who are next to the gunners, and assist them in loading, firing, and spunging the great guns. They carry firelocks, and march along with the store-waggons, both as a guard, and to give their assistance in case a waggon should break down.

**MATT**, in a ship rope yard, junk, &c. beat flat and interwoven; used in order to preserve the yards from galling or rubbing in hoisting or lowering them.

**MATTER**, whatever is extended and capable of making resistance: hence, because all bodies, whether solid or fluid, are extended, and do resist, we conclude that they are material, or made up of matter. See **MECHANICS**.

**MATTHEW**, or *Gospel of St. MATTHEW*, a canonical book of the New Testament.

St. Matthew wrote his gospel in Judea, at the request of those he had converted; and it is thought he began it in the year 41, eight years after Christ's resurrection. It was written, according to the testimony of all the ancients, in the Hebrew or Syriac language, which was then common in Judea; but the Greek version of it, which now passes for the original, it as old as the apostolical times.

**St. MATTHEW the Evangelist's day**, a festival of the Christian church, observed on September 21.

**St. MATTHEW**, in geography, a small island on the

coast of Guinea, planted by the Portuguese, but deserted: W. long. 9°, S. lat. 2° 30'.

**St. MATTHIAS'S day**, a festival of the Christian church, observed on the 24th of February.

**MATTINS**, the first canonical hour, or the first part of the daily service, in the Romish church.

**MATTURANTS**, in pharmacy, medicines which promote the suppuration of tumours.

**MAUNCH**, in heraldry, the figure of an ancient coat-sleeve, borne in many gentlemen's escutcheons.

**MAUNDY THURSDAY**, is the Thursday in Passion-week, which was called Maunday or Mandate-thursday, from the command which our Saviour gave his apostles to commemorate him in the Lord's supper, which he this day instituted; or from the new commandment which he gave them to love one another, after he had washed their feet as a token of his love to them.

**St. MAURA**, an island of the Mediterranean, situated between the province of Epirus, and the island of Cephalonia; subject to Venice: E. long. 21°, N. lat. 38° 50'.

**MAURICE, or MORITZUS**, an island in the Indian ocean, subject to the Dutch: E. long. 55°, S. lat. 20°.

**MAURIENNE. St. JOHN**, the capital of the territory of Maurienne, in Savoy: E. long. 6° 10', N. lat. 45° 18'.

**MAURITANIA**, the ancient name of the coast of Barbary, from the city of Tangier to that of Algiers: the west part of it, in which Tangier stands, was called Mauritania Tingitana; and that farther east, Mauritania Cæsarientis.

**MAUSOLEUM**, a magnificent tomb, or funeral monument. The word is derived from Mausolus, king of Caria, to whom Artemis, his widow, erected a most stately monument, esteemed one of the wonders of the world, and called it, from his name, Mausoleum.

**St. MAWES**, a port and borough town of Cornwall: situated twenty miles north of the Lizard. It sends two members to parliament.

**MAXILLA**, the jaws, or those parts of an animal in which the teeth are set.

**MAXIM**, an established proposition or principle; in which sense it denotes much the same with axiom.

**MAXIMUM**, in mathematics denotes the greatest quantity attainable in any given case.

If a quantity conceived to be generated by motion, increases, or decreases, till it arrives at a certain magnitude or position, and then on the contrary grows lesser or greater, and it be required to determine the said magnitude or position, the question is called a problem de maximis et minimis.

**MAY**, the fifth month of the year, consisting of thirty-one days.

**MAY**, is also the name of a little island, in the mouth of the frith of Forth, in Scotland.

**MAYENNE**, a city of France, in the province of Orleanois: W. long. 45', and N. lat. 48° 20'.

**MAYO**, one of the Cape Verde islands: W. long. 23°, N. lat. 15°.

**MAYO**, is also a county of Ireland, in the province of Connaught, having Sligo on the north, and Roscommon on the south.

**MAYOR**, the chief magistrate of a city or town, chosen annually out of the aldermen.

**MAZARA**, the capital of the province of the same name in Sicily, situated on the south-west coast: E. long.  $12^{\circ} 30'$ , N. lat.  $37^{\circ} 42'$ .

**MEAD**, an agreeable liquor, made of honey and water.

There are many receipts for making mead, of which the following is one of the best. Take four gallons of water, and as much honey as will make it bear an egg; add to this, the rind of three lemons; boil it, and scum it well as it rises. Then take it off the fire, and add the three lemons cut in pieces; pour it into a clean tub or open vessel, and let it work for three days: then scum it well, and pour off the clear part into a cask, and let it stand open till it ceases to make a hissing noise; then stop it up close, and in three months time it will be fine and fit for bottling.

If you would give it a finer flavour, take cloves, mace, and nutmeg, of each four drams; beat them small, tie the powder in a piece of cloth, and put it into the cask.

**MEADOW**, in its general signification, means pasture or grass-land, annually mown for hay; but it is more particularly applied to lands that are so low as to be too moist for cattle to graze upon them in winter without spoiling the sward.

**MEAN**, in general, denotes the middle between two extremes: thus we say, mean distance, mean proportion, &c.

**MEASLES**, in medicine, a cutaneous disease, attended with a fever, in which there is an appearance of eruptions that do not tend to a suppuration. See **MEDICINE**.

**MEASURE**, in geometry, denotes any quantity assumed as one, or unity, to which the ratio of other homogeneous or similar quantities is expressed.

**MEASURE**, in a legal and commercial sense, denotes a certain quantity or proportion of anything bought, sold, valued, or the like. Measures are then various, according to the various kinds and dimensions of the things measured. Hence arise lineal or longitudinal measures, for lines or lengths; square measures, for areas or superficies; and solid or cubic measures, for bodies and their capacities. All which again are very different in different countries, and in different ages, and even many of them for different commodities. Whence arise other divisions of ancient and modern measures, domestic and foreign ones, dry measures, liquid measures, &c. For the different kinds of measures, see **ARITHMETIC**, **GEOMETRY**, and the particular names of measures, as they occur in the alphabetical order.

**MEASURE** is also used to signify the cadence and time observed in poetry, dancing, and music, to render them regular and agreeable.

**MEASURE**, in music, the interval or space of time which the person who beats time takes between the rising and falling of his hand, in order to conduct the movement sometimes quicker and sometimes slower, according to the music or subject that is to be sung or played.

**MEAT**. See **FOOD**, **DIET**, **DRINK**, &c.

**MEATH**, the name of two counties in Ireland, in the province of Leinster, distinguished by the epithets East and West.

**MEATUS AUDITORIUS**, in anatomy. See **ANATOMY**, p. 296.

**MEAUX**, a city in France, twenty-four miles north-east of Paris.

**MECCA**, the capital of Arabia, and place of Mohammed's nativity: E. long  $43^{\circ} 30'$ , N. lat.  $21^{\circ} 20'$ .

It is a large well-built city, in the middle of which stands the caaba, or temple.

## M E C H A N I C S.

**THIS** term, in the common acceptation, implies no more than the nature of what is called the mechanical powers, together with the combination of these powers in the construction of machines. But as the general properties of matter and central forces are necessary in order to a thorough knowledge of mechanics, we have joined all these subjects together under the general name of *Mechanics*.

### *Of MATTER, and its Properties.*

By the word *matter* is here meant every thing that has length, breadth, and thickness, and resists the touch.

The inherent properties of matter are solidity, inactivity, mobility, and divisibility.

The *solidity* of matter arises from its having length, breadth, thickness; and hence it is that all bodies are comprehended under some shape or other, and that every particular body hinders all others from occupying the same part of space which it possesseth. Thus, if a piece of

wood or metal be squeezed ever so hard between two plates, they cannot be brought into contact. And even water or air has this property; for if a small quantity of it be fixed between any other bodies, they cannot be brought to touch one another.

A second property of matter is *inactivity*, or *passiveness*; by which it always endeavours to continue in the state that it is in, whether of rest or motion. And therefore, if one body contains twice or thrice as much matter as another body does, it will have twice or thrice as much inactivity; that is, it will require twice or thrice as much force to give it an equal degree of motion, or to stop it after it hath been put into such a motion.

That matter can never put itself into a motion is allowed by all men. For a stone, lying on the plain surface of the earth, never removes itself from that place, nor does any one imagine it ever can. But most people are apt to believe, that all matter has a propensity to fall from a state of motion into a state of rest; because they see, that if a stone

stone or a cannon-ball be put into ever so violent a motion, it soon stops; not considering that this stoppage is caused, 1. By the gravity or weight of the body, which sinks it to the ground in spite of the impulse; and, 2. By the resistance of the air through which it moves, and by which its velocity is retarded every moment till it falls.

A bowl moves but a short way upon a bowling-green; because the roughness and unevenness of the grassy surface soon creates friction enough to stop it. But if the green were perfectly level, and smooth, and the bowl were perfectly hard, round, and smooth, it would go a great way further; as it would have nothing but the air to resist it: if then the air were taken away, the bowl would go on without any friction, and consequently without any diminution of the velocity it had at setting out: and therefore, if the green were extended quite around the earth, the bowl would go on round and round the earth, for ever.

If the bowl were carried several miles above the earth, and there projected in a horizontal direction, with such a velocity as would make it move more than a semidiameter of the earth, in the time it would take to fall to the earth by gravity: in that case, and if there were no resisting medium in the way, the bowl would not fall to the earth at all; but would continue to circulate round it, keeping always in the same tract, and returning to the same point from which it was projected, with the same velocity as at first. In this manner the moon moves round the earth, although she be as unactive and dead as any stone upon it.

The third property of matter is *mobility*; for we find that all matter is capable of being moved, if a sufficient degree of force be applied to overcome its inactivity or resistance.

The fourth property of matter is *divisibility*, of which there can be no end. For since matters can never be annihilated by cutting or breaking, we can never imagine it to be cut into such small particles, but that if one of them be laid on a table, the uppermost side of it will be further from the table than the undermost side.

Plate CV. fig. 1. That matter is infinitely divisible in a mathematical sense, is easy to be demonstrated. For, let AB be the length of a particle to be divided; and let it be touched at opposite ends by the parallel lines CD and EF, which suppose to be infinitely extended beyond D and F. Set off the equal divisions BG, GH, HI &c. on the line EF, towards the right hand from B; and take a point, as at R, any where towards the left hand from A, in the line CD: Then, from this point draw the right lines RG, RH, RI, &c. each of which will cut off a part from the particle AB. But after any finite number of such lines are drawn, there will still remain a part, as AP, at the top of the particle, which can never be cut off: because the lines DR and EF being parallel, no line can ever be drawn from the point R to any point of the line EF that will coincide with the line RD. Therefore the particle AB contains more than any finite number of parts.

A fifth property of matter is *attraction*, which seems rather to be infused than inherent. Of this there are four kinds, viz. *cohesion*, *gravitation*, *magnetism*, and *electricity*.

The *attraction of cohesion* is that by which the small parts of matter are made to stick and cohere together. Of this we have several instances, some of which follow.

1. If a small glass tube, open at both ends, be dipped in water, the water will rise up in the tube to a considerable height above its level in the basin; which must be owing to the attraction of a ring of particles of the glass all around in the tube, immediately above those to which the water at any instant rises. And when it has risen so high, that the weight of the column balances the attraction of the tube, it rises no higher. This can be no ways owing to the pressure of the air upon the water in the basin; for, as the tube is open at top, it is full of air above the water, which will press as much upon the water in the tube as the neighbouring air does upon any column of an equal diameter in the basin. Besides, if the same experiment be made in an exhausted receiver of the air-pump, there will be found no difference.

2. A piece of loaf-sugar will draw up a fluid, and a sponge will suck in water; and on the same principle sap ascends in trees.

3. If two drops of quicksilver be placed near each other, they will run together, and become one large drop.

4. If two pieces of lead be scraped clean, and pressed together with a twist, they will attract each other so strongly, as to require a force much greater than their own weight to separate them. And this cannot be owing to the pressure of the air, for the same thing will hold in an exhausted receiver.

5. If two polished plates of marble or brass be put together, with a little oil between them to fill up the pores in their surfaces, and prevent the lodgement of any air; they will cohere so strongly, even if suspended in an exhausted receiver, that the weight of the lower plate will not be able to separate it from the upper one. In putting these plates together, the one should be rubbed upon the other, as a joiner does two pieces of wood when he glues them.

6. If two pieces of cork, equal in weight, be put near each other in a basin of water, they will move equally fast toward each other, with an accelerated motion, until they meet: and then, if either of them be moved, it will draw the other after it. If two corks of unequal weights be placed near each other, they will approach with accelerated velocities inversely proportionate to their weights: that is, the lighter cork will move as much faster than the heavier, as the heavier exceeds the lighter in weight. This shews that the attraction of each cork is in direct proportion to its weight or quantity of matter.

This kind of attraction reaches but to a very small distance; for, if two drops of quicksilver be rolled in dust, they will not run together, because the particles of dust keeps them out of the sphere of each other's attraction.

Where the sphere of attraction ends, a *repulsive force* begins; thus, water repels most bodies till they are wet; and hence it is, that a small needle, if dry, swims upon water; and flies walk upon it without wetting their feet.

The repelling force of the particles of a fluid is but small; and therefore, if a fluid be divided, it easily unites again. But if glass, or any other hard substance, be broke

broke into small parts, they cannot be made to stick together again without being first wetted: the repulsion being too great to admit of a re-union.

The repelling force between water and oil is so great, that we find it almost impossible to mix them so as not to separate again. If a ball of light wood be dipt in oil, and then put into water, the water will recede so as to form a channel of some depth all around the ball.

The repulsive force of the particles of air is so great; that they can never be brought so near together by condensation as to make them stick or cohere. Hence it is, that when the weight of the incumbent atmosphere is taken off from any small quantity of air, that quantity will diffuse itself so as to occupy (in comparison) an infinitely greater portion of space than it did before.

*Attraction of gravitation* is that power by which distant bodies tend towards one another. Of this we have daily instances in the falling of bodies to the earth. By this power in the earth it is, that bodies, on whatever side, fall in lines perpendicular to its surface; and consequently, on opposite sides, they fall in opposite directions; all towards the centre, where the force of gravity is as it were accumulated; and by this power it is, that bodies on the earth's surface are kept to it on all sides, so that they cannot fall from it. And as it acts upon all bodies in proportion to their respective quantities of matter, without any regard to their bulks or figures, it accordingly constitutes their weight. Hence,

If two bodies which contain equal quantities of matter, were placed at ever so a distance from one another, and then left at liberty in free space; if there were no other bodies in the universe to affect them, they would fall equally swift towards one another by the power of gravity, with velocities accelerated as they approached each other; and would meet in a point which was half way between them at first. Or, if two bodies containing unequal quantities of matter, were placed at any distance, and left in the same manner at liberty, they would fall towards one another with velocities which would be in an inverse proportion to their respective quantities of matter; and moving faster and faster in their mutual approach, would at last meet in a point as much nearer to the place from which the heavier body began to fall, than to the place from which the lighter body began to fall, as the quantity of matter in the former exceeded that in the latter.

All bodies that we know of have gravity or weight. For, that there is no such thing as positive levity, even in smoke, vapours, and fumes, is demonstrable by experiments on the air-pump: which shews, that although the smoke of a candle ascends to the top of a tall receiver, when full of air; yet upon the air's being exhausted out of the receiver, the smoke falls down to the bottom of it. So, if a piece of wood be immersed in a jar of water, the wood will rise to the top of the water, because it has a less degree of weight than its bulk of water has; but if the jar be emptied of water, the wood falls to the bottom.

As every particle of matter has its proper gravity, the effect of the whole must be in proportion to the number of the attracting particles; that is, as the quantity of matter in the whole body. This is demonstrable by experi-

ments on pendulums; for if they are of equal lengths, whatever their weights be, they vibrate in equal times. Now it is plain, that if one be double or triple the weight of another, it must require a double or triple power of gravity to make it move with the same celerity; just as it would require a double or triple force to project a bullet of twenty or thirty pound weight with the same degree of swiftness that a bullet of ten pounds would require. Hence, it is evident, that the power or force of gravity is always proportional to the quantity of matter in bodies, whatever their bulks or figures are.

Gravity also, like all other virtues or emanations which proceed or issue from a centre, decreases as the distance multiplied by itself increases: that is, a body at twice the distance of another attracts with only a fourth part of the force; at thrice the distance, with a ninth part; at four times the distance, with a sixteenth part; and so on. This too is confirmed by comparing the distance which the moon falls in a minute from a right line touching her orbit, with the distance through which heavy bodies near the earth fall in that time; and also by comparing the forces which retain Jupiter's moons in their orbits, with their respective distances from Jupiter. These forces will be explained afterwards.

The velocity which bodies near the earth acquire in descending freely by the force of gravity, is proportional to the times of their descent. For, as the power of gravity does not consist in a single impulse, but is always operating in a constant and uniform manner, it must produce equal effects in equal times; and consequently in a double or triple time, a double or triple effect; and so, by acting uniformly on the body, must accelerate its motion proportionably to the time of its descent.

To be a little more particular on this subject, let us suppose that a body begins to move with a celerity constantly and gradually increasing, in such a manner, as would carry it through a mile in a minute; at the end of this space it will have acquired such a degree of celerity, as is sufficient to carry it two miles the next minute, tho' it should then receive no new impulse from the cause by which its motion had been accelerated: but if the same accelerating cause continues, it will carry the body a mile farther; on which account, it will have run through four miles at the end of two minutes; and then it will have acquired such a degree of celerity, as is sufficient to carry it through a double space in as much more time, or eight miles in two minutes, even though the accelerating force should act upon it no more. But this force still continuing to operate in an uniform manner, will again, in an equal time, produce an equal effect; and so, by carrying it a mile further, cause it to move through five miles the third minute; for, the celerity already acquired, and the celerity still acquiring, will each have its complete effect. Hence we learn, that if the body should move one mile the first minute, it would move three the second, five the third, seven the fourth, nine the fifth, and so on in proportion.

And thus it appears, that the spaces described in successive equal parts of time, by an uniformly accelerated motion, are always as the odd numbers 1, 3, 5, 7, 9, &c.

&c. and consequently, the whole spaces are as the squares of the times, or of the last acquired velocities. For, the continued addition of the odd numbers yields the squares of all numbers from unity upwards. Thus, 1, is the first odd number, and the square of 1 is 1; 3 is the second odd number, and this added to 1 makes 4, the square of 2; 5 is the third odd number, which added to 4 makes 9, the square of 3; and so on for ever. Since, therefore, the times and velocities proceed evenly and constantly as 1, 2, 3, 4, &c. but the spaces described in each equal time are as 1, 3, 5, 7, &c. it is evident that the space described,

In 1 minute will be - - 1 = square of 1

In 2 minutes - - 1+3 = 4 = square of 2

In 3 minutes - 1+3+5 = 9 = square of 3

In 4 minutes 1+3+5+7 = 16 = square of 4 &c.

As heavy bodies are uniformly accelerated by the power of gravity in their descent, it is plain that they must be uniformly retarded by the same power in their ascent. Therefore, the velocity which a body acquires by falling, is sufficient to carry it up again to the same height from whence it fell; allowance being made for the resistance of the air, or other medium in which the body is moved. Thus, the body D (fig. 2.) in rolling down the inclined plane AB, will acquire such a velocity by the time it arrives at B, as will carry it up to the inclined plane BC, almost to C; and would carry it quite up to C, if the body and plane were perfectly smooth, and the air gave no resistance.—So, if a pendulum were put into motion in a space quite void of air and all other resistance, and had no friction on the point of suspension, it would move for ever; for the velocity it had acquired in falling through the descending part of the arc, would be still sufficient to carry it equally high in the ascending part thereof.

The *centre of gravity* is that point of a body in which the whole force of its gravity or weight is united. Therefore, whatever supports that point bears the weight of the whole body; and whilst it is supported, the body cannot fall, because all its parts are in a perfect equilibrium about that point.

An imaginary line drawn from the centre of gravity of any body towards the centre of the earth, is called the *line of direction*. In this line all heavy bodies descend, if not obstructed.

Since the whole weight of a body is united in its centre of gravity, as that centre ascends or descends we must look upon the whole body to do so too. But as it is contrary to the nature of heavy bodies to ascend of their own accord, or not to descend when they are permitted; we may be sure that, unless the centre of gravity be supported, the whole body will tumble or fall. Hence it is, that bodies stand upon their bases when the line of direction falls within the base; for in this case the body cannot be made to fall without first raising the centre of gravity higher than it was before. Thus, the inclining body ABCD, (fig. 3.) whose centre of gravity is E, stands firmly on its base CDIK, because the line of direction EF falls within the base. But if a weight, as ABGH, be laid upon the top of the body, the centre of gravity of the whole body and weight together is raised up to I; and

and then, as the line of direction ID falls without the base at D, the centre of gravity I is not supported; and the whole body and weight tumble down together.

The broader the base is, and the nearer the line of direction is to the middle or centre of it, the more firmly does the body stand. On the contrary, the narrower the base, and the nearer the line of direction is to the side of it, the more easily may the body be overthrown: a less change of position being sufficient to remove the line of direction out of the base in the latter case than in the former. And hence it is, that a sphere is so easily rolled upon a horizontal plane; and that it is so difficult, if not impossible, to make things which are sharp pointed to stand upright on the point.—From what hath been said, it plainly appears, that if the plane be inclined on which the heavy body is placed, the body will slide down upon the plane whilst the line of direction falls within the base; but it will tumble or roll down when that line falls without the base. Thus, the body A (fig. 4.) will only slide down the inclined plane CD, whilst the body B rolls down upon it.

When the line of direction falls within the base of our feet, we stand; and most firmly, when it is in the middle: but when it is out of that base, we immediately fall. And it is not only pleasing, but even surprising, to reflect upon the various and unthought of methods and postures which we use, to retain this position, or to recover it when it is lost. For this purpose, we bend our body forward when we rise from a chair, or when we go up stairs: and for this purpose a man leans forward when he carries a burden on his back, and backward when he carries it on his breast, and to the right or left side as he carries it on the opposite side.

The quantity of matter in all bodies is in exact proportion to their weights, bulk for bulk. Therefore, heavy bodies are as much more dense or compact than light bodies of the same bulk, as they exceed them in weight.

All bodies are full of pores, or spaces void of matter: and in gold, which is the heaviest of all known bodies, there is perhaps a greater quantity of space than of matter. For the particles of heat and magnetism find an easy passage through the pores of gold; and even water itself has been forced through them. Besides, if we consider how easily the rays of light pass through so solid a body as glass, in all manner of directions, we shall find reason to believe that bodies are exceedingly porous.

All bodies are some way or other affected by heat; and all metallic bodies are expanded in length, breadth, and thickness thereby.—The proportion of the expansion of several metals, according to the best experiments, is nearly thus. Iron and glass as 3, steel 4, copper 4 and one eighth, brass 5, tin 6, lead 6 and one eighth. An iron rod 3 feet long is about one 70th part of an inch longer in summer than in winter.

The expansion of metals by heat, is demonstrated by the following machine, called a pyrometer AA (fig. 5.) is a flat piece of mahogany, in which are fixed four brass studs B, C, D, L; and two pins, one at F, and the other at H. On the pin F turns the crooked index EL, and upon the pin H the straight index GK; against which a piece of watch-spring R bears gently, and so presses it towards

towards the beginning of the scale MN, over which the point of that index moves. This scale is divided into inches and tenth parts of an inch: the first inch is marked 1000, the second 2000, and so on. A bar of metal O is laid into notches in the top of the studs C and D; one end of the bar bearing against the adjusting screw P, and the other end against the crooked index EI, at a 20th part of its length from its centre of motion F.—Now it is plain, that however much the bar O lengthens, it will move that part of the index EI against which it bears just as far: but the crooked end of the same index, near H, being 20 times as far from the centre of motion F as the point is against which the bar bears, it will move 20 times as far as the bar lengthens. And as this crooked end bears against the index GK at only a 20th part of its whole length GS from its centre of motion H, the point S will move through 20 times the space that the point of bearing near H does. Hence, as 20 multiplied by 20 produces 400, it is evident, that if the bar lengthens but a 400th part of an inch, the point S will move a whole inch on the scale; and as every inch is divided into 10 equal parts, if the bar lengthens but the 10th part of the 400th part of an inch, which is only the 4000th part of an inch, the point S will move the tenth part of an inch, which is very perceptible.

To find how much a bar lengthens by heat, first lay it cold into the notches of the studs, and turn the adjusting screw P until the spring R brings the point S of the index GK to the beginning of the divisions of the scale at M: then, without altering the screw any farther, take off the bar, and rub it with a dry woollen cloth till it feels warm: and then, laying it on where it was, observe how far it pushes the point S upon the scale by means of the crooked index EI; and the point S will shew exactly how much the bar has lengthened by the heat of rubbing. As the bar cools, the spring R bearing against the index KG, will cause its point S to move gradually back towards M in the scale: and when the bar is quite cold, the index will rest at M, where it was before the bar was made warm by rubbing. The indexes have small rollers under them at I and K; which, by turning round on the smooth wood as the indexes move, make their motions the easier, by taking off a great part of the friction, which would otherwise be on the pins F and H, and of the points of the indexes themselves on the wood.

Besides the universal properties above mentioned, there are bodies which have properties peculiar to themselves: such as the loadstone, in which the most remarkable are these, 1. It attracts iron and steel only. 2. It constantly turns one of its sides to the north and another to the south, when suspended by a thread that does not twist. 3. It communicates all its properties to a piece of steel when rubbed upon it, without losing any itself.

According to Dr Helsham's experiments, the attraction of the loadstone decreases as the square of the distance increases. Thus, if a loadstone be suspended at one end of a balance, and counterpoised by weights at the other end, and a flat piece of iron be placed beneath it, at the distance of four tenths of an inch, the stone will immediately descend and adhere to the iron. But if the stone be again removed to the same distance, and as many grains

be put into the scale at the other end as will exactly counterbalance the attraction, then, if the iron be brought twice as near the stone as before, that is, only two tenth-parts of an inch from it, there must be four times as many grains put into the scale as before, in order to be a just counterbalance to the attractive force, or to hinder the stone from descending and adhering to the iron. So if four grains will do in the former case, there must be sixteen in the latter. But from some later experiments, made with the greatest accuracy, it is found that the force of magnetism decreases in a ratio between the reciprocal of the square and the reciprocal of the cube of the distance; approaching to the one or the other, as the magnitudes of the attracting bodies are varied.

Several bodies, particularly amber, glass, jet, sealing-wax, agate, and almost all precious stones, have a peculiar property of attracting and repelling light bodies when heated by rubbing. This is called *electrical attraction*; for the properties of which, see *ELECTRICITY*.

#### *Of Central Forces.*

WE have already mentioned it as a necessary consequence arising from the deadness or inactivity of matter, that all bodies endeavour to continue in the state they are in, whether of rest or motion. If the body A (fig. 6.) were placed in any part of free space, where nothing either draws or impels it any way, it would for ever remain in that part of space, because it could have no tendency of itself to remove any way from thence. If it receives a single impulse any way, as suppose from A towards B, it will go on in that direction; for, of itself it could never swerve from a right line, nor stop its course.—When it has gone through the space AB, and met with no resistance, its velocity will be the same at B as it was at A; and this velocity, in as much more time, will carry it through as much more space, from B to C; and so on for ever. Therefore, when we see a body in motion; we conclude that some other substance must have given it that motion; and when we see a body fall from motion to rest, we conclude that some other body or cause stop it.

As all motion is naturally rectilinear, it appears, that a bullet projected by the hand, or shot from a cannon, would for ever continue to move in the same direction it received at first, if no other power diverted its course. Therefore, when we see a body move in a curve of any kind whatever, we conclude it must be acted upon by two powers at least; one putting it in motion, and another drawing it off from the rectilinear course it would otherwise have continued to move in: and whenever that power, which bent the motion of the body from a straight line into a curve, ceases to act, the body will again move on in a straight line, touching that point of the curve in which it was when the action of that power ceased. For example, a pebble moved round in a sling ever so long a time, will fly off the moment it is set at liberty by slipping one end of the sling cord; and will go on in a line touching the circle it described before; which line would actually be a straight one, if the earth's attraction did not affect the pebble, and bring it down to the ground. This shews, that the natural tendency of the pebble, when

put

put into motion, is to continue moving in a straight line, although by the force that moves the sling it be made to revolve in a circle.

The change of motion produced is in proportion to the force impressed: for the effects of natural causes are always proportionate to the force or power of those causes.

By these laws it is easy to prove that a body will describe the diagonal of a square or parallelogram, by two forces conjoined, in the same time that it would describe either of the sides by one force singly. Thus, suppose the body A (fig. 7.) to represent a ship at sea; and that it is drove by the wind, in the right line AB, with such a force as would carry it uniformly from A to B in a minute: then, suppose a stream or current of water running in the direction AD, with such a force as would carry the ship through an equal space from A to D in a minute. By these two forces, acting together at right angles to each other, the ship will describe the line AEC in a minute: which line (because the forces are equal and perpendicular to each other,) will be the diagonal of an exact square. To confirm this law by an experiment, let there be a wooden square ABCD (fig. 8.) so contrived, as to have the part BEFC made to draw out or push into the square at pleasure. To this part let the pulley H be joined, so as to turn freely on an axis, which will be at H when the piece is pushed in, and at *b* when it is drawn out. To this part let the ends of a straight wire *k* be fixed, so as to move along with it, under the pulley: and let the ball G be made to slide easily on the wire. A thread *m* is fixed to this ball, and goes over the pulley to I; by this thread the ball may be drawn up on the wire, parallel to the side AD, when the part BEFC is pushed as far as it will go into the square. But, if this part be drawn out, it will carry the ball along with it, parallel to the bottom of the square DC. By this means, the ball G may either be drawn perpendicularly upward by pulling the thread *m*, or moved horizontally along by pulling out the part BEFC, in equal times, and through equal spaces; each power acting equally and separately upon it. But if, when the ball is at G, the upper end of the thread be tied to the pin I, in the corner A of the fixed square, and the moveable part BEFC be drawn out, the ball will then be acted upon by both the powers together: for it will be drawn up by the thread towards the top of the square, and at the same time carried with its wire *k* towards the right hand BC, moving all the while in the diagonal line L; and will be found at *g* when the sliding part is drawn out as far as it was before, which then will have caused the thread to draw up the ball to the top of the inside of the square, just as high as it was before, when drawn up singly by the thread without moving the sliding part.

If the acting forces are equal, but at oblique angles to each other, so will the sides of the parallelogram be: and the diagonal run through by the moving body will be longer or shorter, according as the obliquity is greater or smaller. Thus, if two equal forces act conjointly upon

the body A, (fig. 9) one having a tendency to move it through the space AB in the same time that the other has a tendency to move it through an equal space AD; it will describe the diagonal AGC in the same time that either of the single forces would have caused it to describe either of the sides. If one of the forces be greater than the other, then one side of the parallelogram will be so much longer than the other. For if one force singly would carry the body through the space AE, in the same time that the other would have carried the space AD, the joint action of both will carry it in the same time through the space AHF, which is the diagonal of the oblique parallelogram ADEF.

If both forces act upon the body in such a manner, as to move it uniformly, the diagonal described will be a straight line; but if one of the forces acts in such a manner as to make the body move faster and faster as it goes forward, then the line described will be a curve. And this is the case of all bodies which are projected in rectilinear directions, and at the same time acted upon by the power of gravity; which has a constant tendency to accelerate their motions in the direction wherein it acts.

#### *Laws of the Planetary motions.*

FROM the uniform projectile motion of bodies in straight lines, and the universal power of gravity or attraction, arises the curvilinear motion of all the heavenly bodies. If the body A (fig. 10.) be projected along the straight line AFH in open space, where it meets with no resistance, and is not drawn aside by any power, it will go on forever with the same velocity, and in the same direction. But if, at the same moment the projectile force is given it at A, the body S begins to attract it with a force duly adjusted\*, and perpendicular to its motion at A, it will then be drawn from the straight line AFH, and forced to revolve about S in the circle ATW; in the same manner, and by the same law, that a pebble is moved round in a sling. And if, when the body is in any part of its orbit (as suppose at K) a smaller body as L, within the sphere of attraction of the body K, be projected in the right line LM, with a force duly adjusted, and perpendicular to the line of attraction LK; then, the small body L will revolve about the large body K in the orbit NO, and accompany it in its whole course round the yet larger body S. But then, the body K will no longer move in the circle ATW; for that circle will now be described by the common centre of gravity between K and L. Nay, even the great body S will not keep in the centre; for it will be the common centre of gravity between all the three bodies S, K, and L, that will remain immovable there. So, if we suppose S and K connected by a wire P that has no weight, and K and L connected by a wire *q* that has no weight, the common centre of gravity of all these three bodies will be a point in the wire P near S; which point being supported, the bodies will be all in *equilibrium* as they move round it. Though indeed, strictly speaking, the common centre of gravity of all the three bodies will not be in the wire

\* To make the projectile force a just balance to the gravitating power, so as to keep the planet moving in a circle, it must give such a velocity as the planet would acquire by gravity when it had fallen through half the femidiameter of that circle.

P but when these bodies are all in a right line. Here, S may represent the sun, K the earth, and L the moon.

In order to form an idea of the curves described by two bodies revolving about their common centre of gravity, whilst they themselves with a third body are in motion round the common centre of gravity of all the three; let us first suppose E (Plate CVI. fig. 1.) to be the sun, and  $e$  the earth going round him with any moon; and their moving forces regulated as above. In this case, whilst the earth goes round the sun in the dotted circle RTUWX, &c. the sun will go round the circle ABD, whose centre C is the common centre of gravity between the sun and earth: the right line  $\beta A$  representing the mutual attraction between them, by which they are as firmly connected as if they were fixed at the two ends of an iron bar strong enough to hold them. So, when the earth is at  $e$ , the sun will be at E; when the earth is at T, the sun will be at F; and when the earth is at  $g$ , the sun will be at G, &c.

Now, let us take in the moon  $q$  (at the top of the figure,) and suppose the earth to have no progressive motion about the sun; in which case, whilst the moon revolves about the earth in her orbit  $\mathcal{R}PQD$ , the earth will revolve in the circle S 13, whose centre R is the common centre of gravity of the earth and moon; they being connected by the mutual attraction between them in the same manner as the earth and sun are.

But the truth is, that whilst the moon revolves about the earth, the earth is in motion about the sun; and now, the moon will cause the earth to describe an irregular curve, and not a true circle, round the sun; it being the common centre of gravity of the earth and moon that will then describe the same circle which the earth would have moved in, if it had not been attended by a moon. For, supposing the moon to describe a quarter of her progressive orbit about the earth in the time that the earth moves from  $e$  to  $f$ , it is plain that when the earth comes to  $f$ , the moon will be found at  $r$ ; in which time, their common centre of gravity will have described the dotted arc R1T, the earth the curve R5f, and the moon the curve  $q14r$ . In the time that the moon describes another quarter of her orbit, the centre of gravity of the earth and moon will describe the dotted arc T2U, the earth the curve  $f6g$ , and the moon the curve  $r15s$ , and so on.—And thus, whilst the moon goes once round the earth in her progressive orbit, their common centre of gravity describes the regular portion of a circle R1T2U3V4W, the earth the irregular curve R5f6g7b8i, and the moon the yet more irregular curve  $q14r15s16t17u$ ; and then, the same kind of tracks over again.

The centre of gravity of the earth and moon is 6000 miles from the earth's centre towards the moon; therefore the circle S 13 which the earth describes round that centre of gravity (in every course of the moon round her orbit) is 12000 miles in diameter. Consequently, the earth is 12000 miles nearer the sun at the time of full moon than at the time of new. [See the earth at  $f$  and at  $b$ .]

To avoid confusion in so small a figure, we have supposed the moon to go only twice and a half round the earth, in the time that the earth goes once round the sun: it

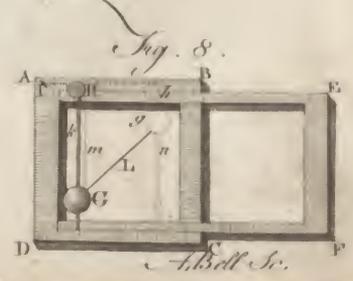
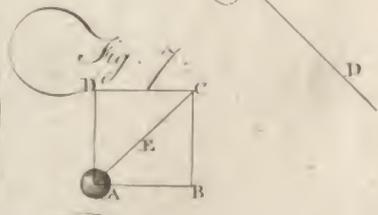
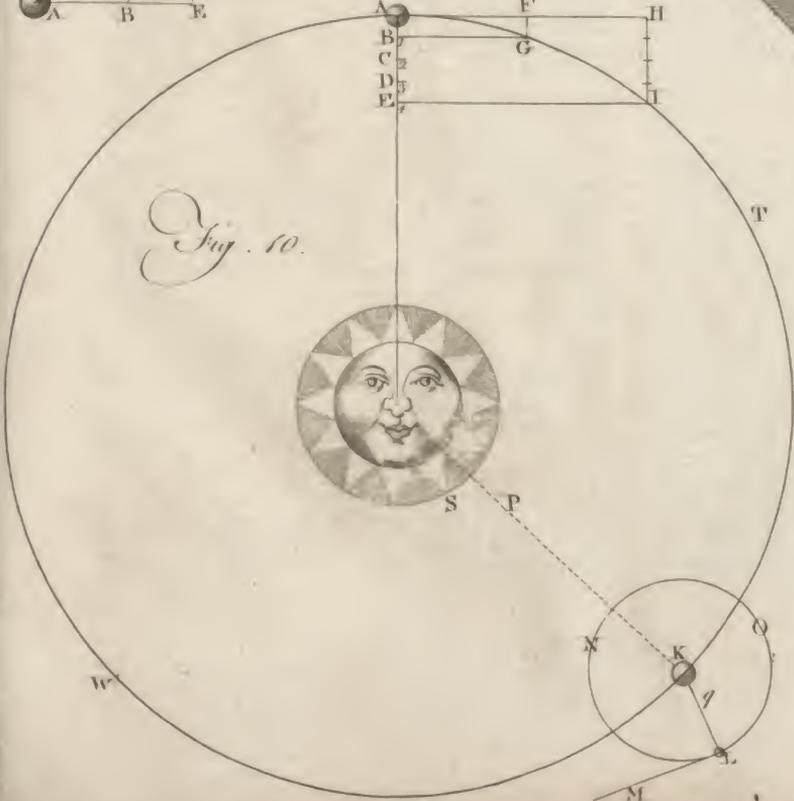
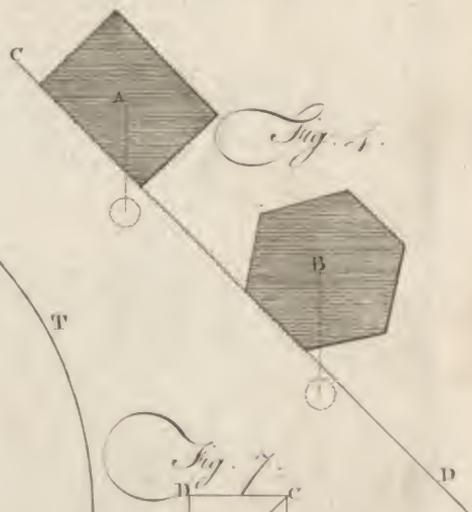
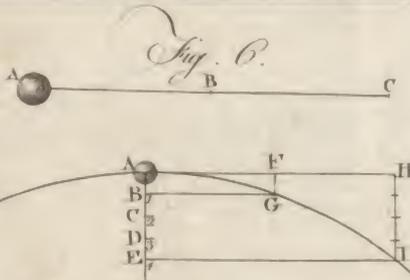
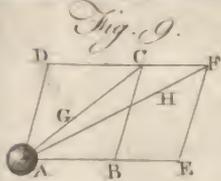
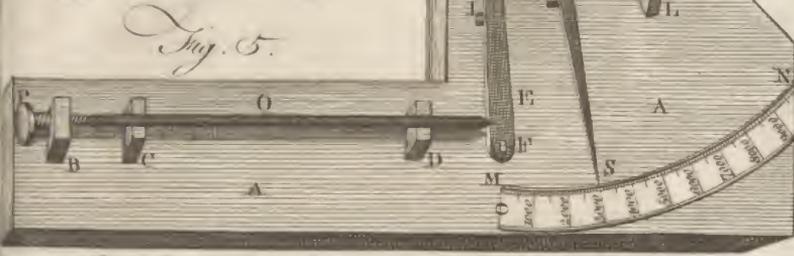
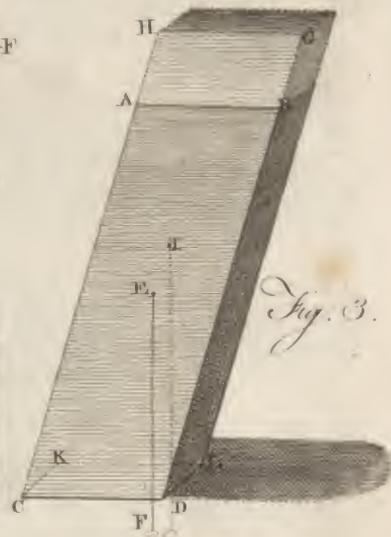
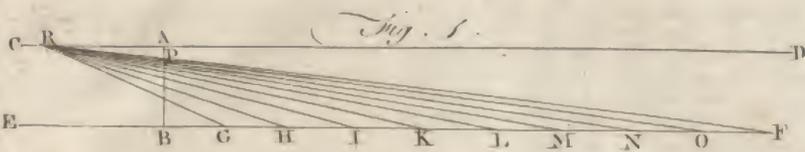
being impossible to take in all the revolutions which she makes in a year; and to give a true figure of her path, unless we should make the semidiameter of the earth's orbit at least 84 inches; and then, the proportionial semidiameter of the moon's orbit would be only a quarter of an inch.

If the moon made any complete number of revolutions about the earth in the time that the earth makes one revolution about the sun, the paths of the sun and moon would return into themselves at the end of every year; and so be the same over again: but they return not into themselves in less than 19 years nearly; in which time, the earth makes nearly 19 revolutions about the sun, and the moon 235 about the earth.

If the planet A (Plate CV. fig. 10.) be attracted towards the sun, with such a force as would make it fall from A to B, in the time that the projectile impulse would have carried it from A to F; it will describe the arc AG by the combined action of these forces, in the same time that the former would have caused it to fall from A to B, or the latter have carried it from A to F. But, if the projectile force had been twice as great, that is, such as would have carried the planet from A to H, in the same time that now, by the supposition, it carries it only from A to F; the sun's attraction must then have been four times as strong as formerly, to have kept the planet in the circle ATW; that is, it must have been such as would have caused the planet to fall from A to E, which is four times the distance of A from B, in the time that the projectile force singly would have carried it from A to H, which is only twice the distance of A from F. Thus, a double projectile force will balance a quadruple power of gravity in the same circle; as appears plain by the figure, and shall soon be confirmed by an experiment.

Plate CVI. fig. 2. The whirling-table is a machine contrived for shewing experiments of this nature. AA is a strong frame of wood, B a winch or handle fixed on the axis C of the wheel D, round which is the catgut string F, which also goes round the small wheels G and K, crossing between them and the great wheel D. On the upper end of the axis of the wheel G, above the frame, is fixed the round board  $d$ , to which the bearer MSX may be fastened occasionally, and removed when it is not wanted. On the axis of the wheel H is fixed the bearer NTZ: and it is easy to see, that when the winch B is turned, the wheels and bearers are put into a whirling motion.

Each bearer has two wires, W, X, and Y, Z, fixed and screwed tight into them at the ends by nuts on the outside. And when these nuts are unscrewed, the wires may be drawn out in order to change the balls U and V, which slide upon the wires by means of brass loops fixed into the balls, which keep the balls up from touching the wood below them. A strong silk line goes through each ball, and is fixed to it at any length from the centre of the bearer to its end, as occasion requires, by a nut-screw at the top of the ball; the shank of the screw going into the centre of the ball and pressing the line against the under side of the hole that it goes through.—The line goes from the ball, and under a small pulley fixed in the middle of the bearer; then up through a socket in the round plate



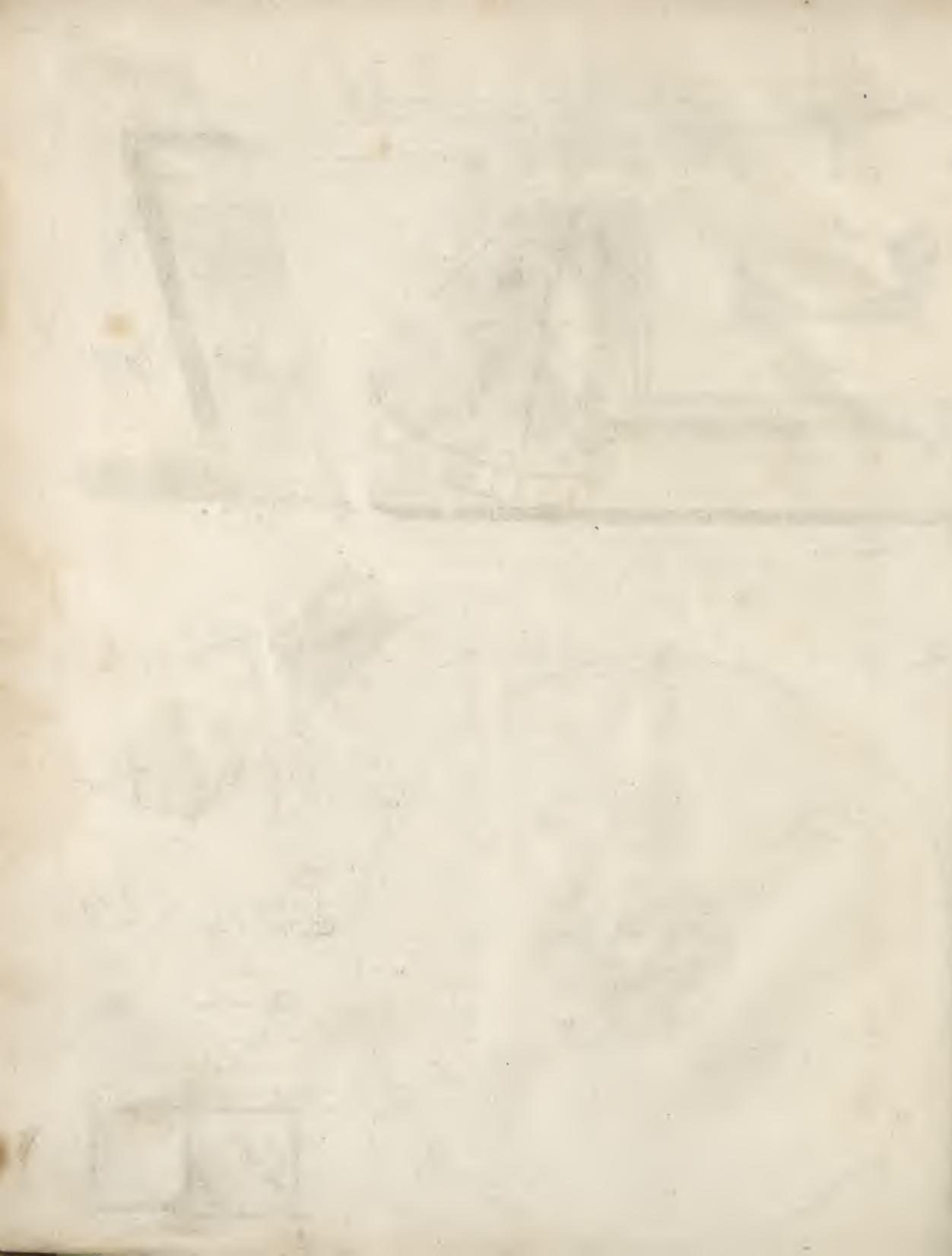


plate (see S and T) in the middle of each bearer; then through a slit in the middle of the square top (O and P) of each tower, and, going over a small pulley on the top, comes down again the same way, and is at last fastened to the upper end of the socket fixt in the middle of the above-mentioned round plate. These plates S and T have each four round holes near their edges for letting them slide up and down upon the wires which make the corner of each tower. The balls and plates being thus connected each by its particular line, it is plain, that if the balls be drawn outward, or towards the ends M and N of their respective bearers, the round plates S and T will be drawn up to the top of their respective towers O and P.

There are several brass weights, some of two ounces, some of three, and some of four, to be occasionally put within the towers O and P, upon the round plates S and T: each weight having a round hole in the middle of it, for going upon the sockets or axes of the plates, and is slit from the edge to the hole, for allowing it to be slipped over the foresaid line which comes from each ball to its respective plate.

The experiments to be made by this machine are,

1. Take away the bearer MX, and take the ivory ball *a*, to which the line or silk cord *b* is fastened at one end; and having made a loop on the other end of the cord, put the loop over a pin fixt in the centre of the board *d*. Then, turning the winch B to give the board a whirling motion, you will see that the ball does not immediately begin to move with the board; but, on account of its inactivity, it endeavours to continue in the state of rest which it was in before.—Continue turning, until the board communicates an equal degree of motion with its own to the ball; and then turning on; you will perceive that the ball will remain upon one part of the board, keeping the same velocity with it, and having no relative motion upon it, as is the case with every thing that lies loose upon the plane surface of the earth, which having the motion of the earth communicated to it, never endeavours to remove from that place. But stop the board suddenly by hand, and the ball will go on, and continue to revolve upon the board, until the friction thereof stops its motion: which shews, that matter being once put into motion, would continue to move for ever, if it met with no resistance. In like manner, if a person stands upright in a boat before it begins to move, he can stand firm; but the moment the boat sets off, he is in danger of falling towards that place which the boat departs from: because, as matter, he has no natural propensity to move. But when he acquires the motion of the boat, let it be ever so swift, if it be smooth and uniform, he will stand as upright and firm as if he was on the plain shore; and if the boat strike against any obstacle, he will fall towards that obstacle; on account of the propensity he has, as matter, to keep the motion which the boat has put him into.

2. Take away this ball, and put a longer cord to it, which may be put down through the hollow axis of the bearer MX, and wheel G, and fix a weight to the end of the cord below the machine; which weight, if left at liberty, will draw the ball from the edge of the whirling-board to its centre.

Draw off the ball a little from the centre, and turn the winch; then the ball will go round and round with the board, and will gradually fly off farther and farther from the centre, and raise up the weight below the machine: which shews that all bodies revolving in circles have a tendency to fly off from these circles, and must have some power acting upon them from the centre of motion, to keep them from flying off. Stop the machine, and the ball will continue to revolve for some time upon the board; but as the friction gradually stops its motion, the weight acting upon it will bring it nearer and nearer to the centre in every revolution, until it brings it quite thither. This shews, that if the planets met with any resistance in going round the sun, its attractive power would bring them nearer and nearer to it in every revolution, until they fell into it.

3. Take hold of the cord below the machine with one hand, and with the other throw the ball upon the round board as it were at right angles to the cord, by which means it will go round and round upon the board. Then; observing with what velocity it moves, pull the cord below the machine, which will bring the ball nearer to the centre of the board, and you will see that the nearer the ball is drawn to the centre, the faster it will revolve; as those planets which are nearest the sun revolve faster than those which are more remote; and not only go round sooner, because they describe smaller circles, but even move faster in every part of their respective circles.

Take away this ball, and apply the bearer MX, whose centre of motion is in its middle at *w*, directly over the centre of the whirling-board *d*. Then put two balls (V and U) of equal weights upon their bearing wires; and having fixed them at equal distances from their respective centres of motion *w* and *x* upon their silk cords, by the screw-nuts, put equal weights in the towers O and P. Lastly, put the catgut strings E and F upon the grooves G and H of the small wheels; which being of equal diameters, will give equal velocities to the bearers above, when the winch B is turned; and the balls U and V will fly off towards M and N, and will raise the weights in the towers at the same instant. This shews, that when bodies of equal quantities of matter revolve in equal circles with equal velocities, their centrifugal forces are equal.

5. Take away these equal balls, and, instead of them, put a ball of six ounces into the bearer MX, at a sixth part of the distance *wz* from the centre, and put a ball of one ounce into the opposite bearer, at the whole distance *xy*, which is equal to *wz* from the centre of the bearer; and fix the ball at these distances on their cords, by the screw-nuts at top; then the ball U, which is six times as heavy as the ball V, will be at only a sixth part of the distance from its centre of motion; and consequently will revolve in a circle of only a sixth part of the circumference of the circle in which V revolves. Now, let any equal weights be put into the towers, and the machine be turned by the winch; which (as the catgut string is on equal wheels below) will cause the balls to revolve in equal times; but V will move six times as fast as U, because it revolves in a circle of six times its radius; and both the weights in the towers will rise at once. This shews, that the centrifugal forces of revolving bodies, (or their

their tendencies to fly off from the circles they describe) are in direct proportion to their quantities of matter multiplied into their respective velocities, or into their distances from the centres of their respective circles. For, supposing  $U$ , which weighs 6 ounces, to be two inches from its centre of motion  $w$ , the weight multiplied by the distance is 12; and supposing  $V$ , which weighs only one ounce, to be 12 inches distant from its centre of motion  $x$ ; the weight 1 ounce multiplied by the distance 12 inches is 12. And as they revolve in equal times, their velocities are as their distances from the centre, namely, as 1 to 6.

If these two balls be fixed at equal distances from their respective centres of motion, they will move with equal velocities; and if the tower  $O$  has 6 times as much weight put into it as the tower  $P$  has, the balls will raise their weight at the same moment. This shews, that the ball  $U$ , being six times as heavy as the ball  $V$ , has six times as much centrifugal force, in describing an equal circle with an equal velocity.

6. If bodies of equal weights revolve in equal circles with unequal velocities, their centrifugal forces are as the squares of the velocities. To prove this law by an experiment, let two balls  $U$  and  $V$  of equal weights be fixed on their cords at equal distances from their respective centres of motion  $w$  and  $x$ : and then let the catgut string  $E$  be put round the wheel  $K$  (whose circumference is only one half of the circumference of the wheel  $H$  or  $G$ ) and over the pulley  $s$  to keep it tight; and let four times as much weight be put in the tower  $P$  as in the tower  $O$ . Then turn the winch  $B$ , and the ball  $V$  will revolve twice as fast as the ball  $U$  in a circle of the same diameter, because they are equidistant from the centres of the circles in which they revolve; and the weights in the towers will both rise at the same instant; which shews, that a double velocity in the same circle will exactly balance a quadruple power of attraction in the centre of the circle. For the weights in the towers may be considered as the attractive forces in the centres, acting upon the revolving balls; which, moving in equal circles, is the same thing as if they both moved in one and the same circle.

7. If bodies of equal weights revolve in unequal circles, in such a manner that the squares of the times of their going round are as the cubes of their distances from the centres of the circles they describe; their centrifugal forces are inversely as the squares of their distances from those centres. For, the catgut string remaining as in the last experiment, let the distance of the ball  $V$  from the centre  $x$  be made equal to two of the cross divisions on its bearer, and the distance of the ball  $U$  from the centre  $w$  be three and a sixth part; the balls themselves being of equal weights, and  $V$  making two revolutions by turning the winch in the time that  $U$  makes one: so that if we suppose the ball  $V$  to revolve in one moment, the ball  $U$  will revolve in two moments, the squares of which are one and four: for the square of 1 is only 1, and the square of 2 is 4; therefore the square of the period or revolution of the ball  $V$  is contained 4 times in the square of the ball  $U$ . But the distance of  $V$  is 2, the cube of which is 8; and the distance of  $U$  is  $3\frac{1}{6}$ , the cube of which is 32 very nearly; in which 8 is contained four

times; and therefore, the squares of the periods of  $V$  and  $U$  are to one another as the cubes of their distances from  $x$  and  $w$ , which are the centres of their respective circles. And if the weight in the tower  $O$  be four ounces, equal to the square of 2, the distance of  $V$  from the centre  $x$ ; and the weight in the tower  $P$  be 10 ounces, nearly equal to the square of  $3\frac{1}{6}$ , the distance of  $U$  from  $w$ ; it will be found, upon turning the machine by the winch, that the balls  $U$  and  $V$  will raise their respective weights at very nearly the same instant of time. Which confirms that famous proposition of KEPLER, *viz.* That the squares of the periodical times of the planets round the sun are in proportion to the cubes of their distances from him; and that the sun's attraction is inversely as the square of the distance from its centre: that is, at twice the distance, his attraction is four times less; and thrice the distance, nine times less; at four times the distance, sixteen times less; and so on, to the remotest part of the system.

8. Take off the catgut string  $E$  from the great wheel  $D$  and the small wheel  $H$ , and let the string  $F$  remain upon the wheels  $D$  and  $G$ . Take away also the bearer  $MX$  from the whirling-board  $d$ , and instead thereof put the machine  $AB$  (fig. 4.) upon it, fixing this machine to the centre of the board by the pins  $c$  and  $d$ , in such a manner, that the end  $ef$  may rise above the board to an angle of 30 or 40 degrees. In the upper side of this machine there are two glass tubes  $a$  and  $b$ , close stop'd at both ends; and each tube is about three quarters full of water. In the tube  $a$  is a little quicksilver, which naturally falls down to the end  $a$  in the water, because it is heavier than its bulk of water; and on the tube  $b$  is a small cork which floats upon the top of the water at  $e$ , because it is lighter; and it is small enough to have liberty to rise or fall in the tube. While the board  $b$  with this machine upon it continues at rest, the quicksilver lies at the bottom of the tube  $a$ , and the cork floats on the water near the top of the tube  $b$ . But, upon turning the winch, and putting the machine in motion, the contents of each tube will fly off towards the uppermost ends (which are farthest from the centre of motion) the heaviest with the greatest force. Therefore, the quicksilver in the tube  $a$  will fly off quite to the end  $f$ , and occupy its bulk of space there, excluding the water from that place, because it is lighter than quicksilver; but the water in the tube  $b$  flying off to its higher end  $e$ , will exclude the cork from that place, and cause the cork to descend towards the lowermost end of the tube, where it will remain upon the lowest end of the water near  $b$ ; for the heavier body having the greater centrifugal force, will therefore possess the uppermost part of the tube; and the lighter body will keep between the heavier and the lowermost part.

This demonstrates the absurdity of the Cartesian doctrine of the planets moving round the sun in vortices: for, if the planet be more dense or heavy than the bulk of the vortex, it will fly off therein, farther and farther from the sun; if less dense, it will come down to the lowest part of the vortex, at the sun: and the whole vortex itself must be surrounded with something like a great wall, otherwise it would fly off, planets and all together.

But

But while gravity exists, there is no occasion for such vortexes; and when it ceases to exist, a stone thrown upwards will never return to the earth again.

9. If a body be so placed upon the whirling board of the machine (fig. 1.) that the centre of gravity of the body be directly over the centre of the board, and the board be put into ever so rapid a motion by the winch B, the body will turn round with the board, but will not remove from the middle of it: for, as all parts of the body are in *equilibrio* round its centre of gravity, and the centre of gravity is at rest in the centre of motion, the centrifugal force of all parts of the body will be equal at equal distances from its centre of motion; and therefore the body will remain in its place. But if the centre of gravity be placed ever so little out of the centre of motion, and the machine be turned swiftly round, the body will fly off towards that side of the board on which its centre of gravity lies. Thus, if the wire C (fig. 5.) with its little ball B be taken away from the demi-globe A, and the flat side *ef* of this demi-globe be laid upon the whirling-board of the machine, so as their centres may coincide; if then the board be turned ever so quick by the winch, the demi-globe will remain where it was placed. But if the wire C be screwed in the demi-globe at *d*, the whole becomes one body, whose centre of gravity is now at or near *d*. Let the pin *c* be fixed in the centre of the whirling-board, and the deep groove *b* cut in the flat side of the demi-globe be put upon the pin, so as the pin may be in the centre of A [See fig. 6. where this groove is represented at *b*] and let the whirling board be turned by the winch, which will carry the little ball B (fig. 5.) with its wire C, and the demi-globe A, all round the centre-pin *c*; and then the centrifugal force of the little ball B, which weighs only one ounce, will be so great, as to draw off the demi-globe A, which weighs two pounds, until the end of the groove at *e* strikes against the pin *c*, and so prevents the demi-globe A from going any farther; otherwise, the centrifugal force of B would have been great enough to have carried A quite off the whirling-board. Which shews, that if the sun were placed in the very centre of the orbits of the planets, it could not possibly remain there; for the centrifugal forces of the planets would carry them quite off, and the sun with them; especially when several of them happened to be in any one quarter of the heavens. For the sun and planets are as much connected by the mutual attraction that subsists between them, as the bodies A and B are by the wire C which is fixed to them both. And even if there were but one single planet in the whole heavens to go round ever so large a sun in the centre of its orbit, its centrifugal force would soon carry off both itself and the sun. For, the greatest body placed in any part of free space could be easily moved: because if there were no other body to attract it, it could have no weight or gravity of itself; and consequently, though it could have no tendency of itself to remove from that part of space; yet it might be very easily by any other substance. And perhaps it was this consideration which made the celebrated ARCHIMEDES say, that if he had a proper place at some distance from the earth whereon to fix his machinery, he could move the whole earth.

10. As the centrifugal force of the light body B will not allow the heavy body A to remain in the centre of motion, even though it be 24 times as heavy as B; let us now take the ball A (fig. 7.) which weighs 6 ounces, and connect it by the wire C with the ball B, which weighs only one ounce; and let the fork E be fixed into the centre of the whirling-board; then, hang the balls upon the fork by the wire C in such a manner that they may exactly balance each other; which will be when the centre of gravity between them, in the wire at *d*, is supported by the fork. And this centre of gravity is as much nearer to the centre of the ball A, than to the centre of the ball B, as A is heavier than B, allowing for the weight of the wire on each side of the fork. This done, let the machine be put into motion by the winch; and the balls A and B will go round their common centre of gravity *d*, keeping their balance, because either will not allow the other to fly off with it. For, supposing the ball B to be only one ounce in weight, and the ball A to be six ounces; then, if the wire C were equally heavy on each side of the fork, the centre of gravity *d* would be six times as far from the centre of the ball B as from the centre of the ball A, and consequently B will revolve with a velocity six times as great as A does; which will give B six times as much centrifugal force as any single ounce of A has: but then, as B is only one ounce, and A six ounces, the whole centrifugal force of A will exactly balance the whole centrifugal force of B; and therefore, each body will detain the other so as to make it keep in its circle. This shews that the sun and planets must all move round the common centre of gravity of the whole system, in order to preserve that just balance which takes place among them. For, the planets being as unactive and dead as the above balls, they could no more have put themselves into motion than these balls can; nor have kept in their orbits, without being balanced at first with the greatest degree of exactness upon their common centre of gravity by the Almighty Hand that made them and put them in motion.

Perhaps it may be here asked, that since the centre of gravity between these balls must be supported by the fork E in this experiment, what prop it is that supports the centre of gravity of the solar system, and consequently bears the weight of all the bodies in it; and by what is the prop itself supported? The answer is easy and plain; for the centre of gravity of our balls must be supported, because they gravitate towards the earth, and would therefore fall to it: but as the sun and planets gravitate only towards one another, they have nothing else to fall to; and therefore have no occasion for any thing to support their common centre of gravity: and if they did not move round that centre, and consequently acquire a tendency to fly off from it by their motions, their mutual attractions would soon bring them together; and so the whole would become one mass in the sun: which would also be the case if their velocities round the sun were not quick enough to create a centrifugal force equal to the sun's attraction.

But after all this nice adjustment, it appears evident, that the Deity cannot withdraw his regulating hand from his works, and leave them to be solely governed by the

laws which he has impressed upon them at first. For if he should once leave them so, their order would in time come to an end; because the planets must necessarily disturb one another's motions by their mutual attractions, when several of them are in the same quarter of the heavens; as is often the case: and then, as they attract the sun more towards that quarter than when they are in a manner dispersed equably around him, if he was not at that time made to describe a portion of a larger circle round the common centre of gravity, the balance would then be immediately destroyed; and as it could never restore itself again, the whole system would begin to fall together, and would in time unite in a mass at the sun.—Of this disturbance we have a very remarkable instance in the comet which appeared lately; and which, in going last up before from the sun, went so near to Jupiter, and was so affected by his attraction, as to have the figure of its orbit much changed; and not only so, but to have its period altered, and its course to be different in the heavens from what it was last before.

11. Take away the fork and balls from the whirling-board, and place the trough AB (fig. 8.) thereon, fixing its centre to the centre of the whirling-board by the pin H. In this trough are two balls D and E, of unequal weights, connected by a wire *f*; and made to slide easily upon the wire C stretched from end to end of the trough, and made fast by nut-screws on the outside of the ends. Let these balls be so placed upon the wire C, that their common centre of gravity *g* may be directly over the centre of the whirling board. Then, turn the machine by the winch ever so swiftly, and the trough and balls will go round their centre of gravity so as neither of them will fly off; because, on account of the equilibrium, each ball detains the other with an equal force acting against it. But if the ball E be drawn a little more towards the end of the trough at A, it will remove the centre of gravity towards that end from the centre of motion; and then, upon turning the machine, the little ball E will fly off, and strike with a considerable force against the end A, and draw the great ball B into the middle of the trough. Or, if the great ball D be drawn towards the end B of the trough, so that the centre of gravity may be a little towards that end from the centre of motion, and the machine be turned by the winch, the great ball D will fly off, and strike violently against the end B of the trough, and will bring the little ball E into the middle of it. If the trough be not made very strong, the ball D will break through it.

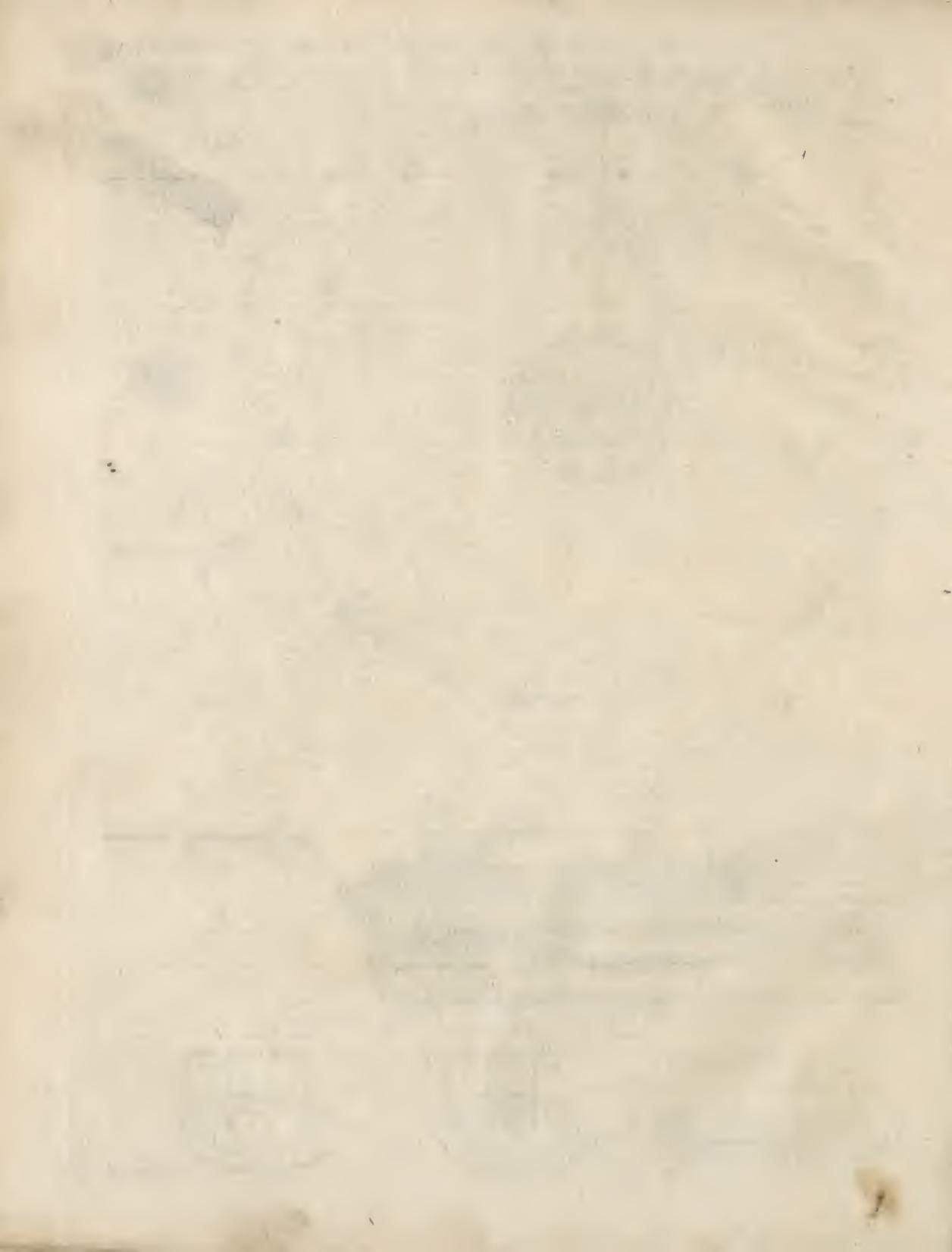
12. The reason why the tides rise at the same absolute time on opposite sides of the earth, and consequently in opposite directions, is made abundantly plain by a new experiment on the whirling table. The cause of their rising on the side next the moon every one understands to be owing to the moon's attraction: but why they should rise on the opposite side at the same time, where there is no moon to attract them, is perhaps not so generally understood. For it would seem that the moon should rather draw the waters (as it were) closer to that side, than raise them upon it, directly contrary to her attractive force. Let the circle *abcd* (fig. 9.) represent the earth, with its side *e* turned toward the moon, which will then attract

the waters so as to raise them from *c* to *g*. But the question is, why should they rise as high at that very time on the opposite side, from *a* to *e*? In order to explain this, let there be a plate AB (fig. 10.) fixed upon one end of the flat bar DC; with such a circle drawn upon it as *abcd* (in fig. 9.) to represent the round figure of the earth and sea; and such an ellipsis as *efgb* to represent the swelling of the tide at *e* and *g*, occasioned by the influence of the moon. Over this plate AB let the three ivory balls *e, f, g* be hung by the silk lines *b, i, k*, fastened to the tops of the crooked wires H, I, K, in such a manner, that the ball at *e* may hang freely over the side of the circle *e*, which is farthest from the moon M (at the other end of the bar); the ball at *f* may hang freely over the centre, and the ball at *g* hang over the side of the circle *g*, which is nearest the moon. The ball *f* may represent the centre of the earth, the ball *g* some water on the side next the moon, and the ball *e* some water on the opposite side. On the back of the moon M is fixt the short bar N parallel to the horizon, and there are three holes in it above the little weights *p, q, r*. A silk thread *o* is tied to the line *k* close above the ball *g*, and, passing by one side of the moon M, goes through a hole in the bar N, and has the weight *p* hung to it. Such another thread *n* is tied to the line *i*, close above the ball *f*, and, passing through the centre of the moon M and middle of the bar N, has the weight *q* hung to it, which is lighter than the weight *p*. A third thread *m* is tied to the line *b*, close above the ball *e*, and passing by the other side of the moon M, through the bar N, has the weight *r* hung to it, which is lighter than the weight *q*.

The use of these three unequal weights is to represent the moon's unequal attraction at different distances from her. With whatever force she attracts the centre of the earth, she attracts the side next her with a greater degree of force, and the side farthest from her with a less. So, if the weights are left at liberty, they will draw all the three balls towards the moon with different degrees of force; and cause them to make the appearance shewn in (fig. 11.) by which means they are evidently farther from each other than they would be if they hung at liberty by the lines *b, i, k*; because the lines would then hang perpendicularly. This shews, that as the moon attracts the side of the earth which is nearest her with a greater degree of force than she does the centre of the earth, she will draw the water on that side more than she draws the centre, and so causes it to rise on that side: and as she draws the centre more than she draws the opposite side, the centre will recede farther from the surface of the water on that opposite side, and so leave it as high there as she raised it on the side next to her. For, as the centre will be in the middle between the tops of the opposite elevations, they must of course be equally high on both sides at the same time.

But upon this supposition the earth and moon would soon come together; and to be sure they would, if they had not a motion round their common centre of gravity, to create a degree of centrifugal force sufficient to balance their mutual attraction. This motion they have; for as the moon goes round her orbit every month, at the





the distance of 240000 miles from the earth's centre, and of 234000 miles from the centre of gravity of the earth and moon, so does the earth go round the same centre of gravity every month at the distance of 6000 miles from it; that is, from it to the centre of the earth. Now as the earth is (in round numbers) 8000 miles in diameter, it is plain that its side next the moon is only 2000 miles from the common centre of gravity of the earth and moon; its centre 6000 miles distant therefrom; and its farthest side from the moon 10000. Therefore the centrifugal forces of these parts are as 2000, 6000, and 10000; that is, the centrifugal force of any side of the earth, when it is turned from the moon, is five times as great as when it is turned towards the moon. And as the moon's attraction (expressed by the number 6000) at the earth's centre keeps the earth from flying out of this monthly circle, it must be greater than the centrifugal force of the waters on the side next her; and consequently, her greater degree of attraction on that side is sufficient to raise them; but as her attraction on the opposite side is less than the centrifugal force of the water there, the excess of this force is sufficient to raise the water just as high on the opposite side.—To prove this experimentally, let the bar DC (fig. 10.) with its furniture be fixed upon the whirling-board of the machine (fig. 2.) by pushing the pin P into the centre of the board; which pin is in the centre of gravity of the whole bar with its three balls *e, f, g*, and moon M. Now, if the whirling-board and bar be turned slowly round by the winch, until the ball *f* hangs over the centre of the circle, as in fig. 11. the ball *g* will be kept towards the moon by the heaviest weight *p*, (fig. 9.) and the ball *e*, on account of its greater centrifugal force, and the lesser weight *r*, will fly off as far to the other side as in fig. 12. And so, whilst the machine is kept turning, the balls *e* and *g* will hang over the ends of the ellipse *l, f, k*. So that the centrifugal force of the ball *e* will exceed the moon's attraction just as much as her attraction exceeds the centrifugal force of the ball *g*, whilst her attraction just balances the centrifugal force of the ball *f*, and makes it keep in its circle. And hence it is evident that the tides must rise to equal heights at the same time on opposite sides of the earth. This experiment, to the best of my knowledge, is entirely new.

From the principles thus established, it is evident that the earth moves round the sun, and not the sun round the earth: for the centrifugal law will never allow a great body to move round a small one in any orbit whatever; especially when we find, that if a small body moves round a great one, the great one must also move round the common centre of gravity between them two. And it is well known, that the quantity of matter in the sun is 227000 times as great as the quantity of matter in the earth. Now, as the sun's distance from the earth is at least 81,000,000 of miles, if we divide that distance by 227000, we shall have only 357 for the number of miles that the centre of gravity between the sun and earth is distant from the sun's centre. And as the sun's semidiameter is  $\frac{1}{2}$  of a degree, which, at so great a distance as that of the sun, must be no less than 381500 miles, if this be divided by 357, the quotient will be  $1068\frac{2}{3}$ ,

which shews that the common centre of gravity is within the body of the sun, and is only the  $1068\frac{2}{3}$  part of his semidiameter from his centre toward his surface.

All globular bodies, whose parts can yield, and which do not turn on their axes, must be perfect spheres, because all parts of their surfaces are equally attracted toward their centres. But all such globes which do turn on their axes, will be oblate spheroids; that is, their surfaces will be higher, or farther from the centre, in the equatorial than in the polar regions. For, as the equatorial parts move quickest, they must have the greatest centrifugal force; and will therefore recede farthest from the axis of motion. Thus, if two circular hoops AB and CD, (Plate CVII. fig. 1.) made thin and flexible, and crossing one another at right angles, be turned round their axis EF by means of the winch *m*, the wheel *n*, and pinion *o*, and the axis be loose in the pole or intersection *e*, the middle parts A, B, C, D will swell out so as to strike against the sides of the frame at F and G, if the pole *e*, in linking to the pin E, be not stopp'd by it from sinking farther: so that the whole will appear of an oval figure, the equatorial diameter being considerably longer than the polar. That our earth is of this figure, is demonstrable from actual measurement of some degrees on its surface, which are found to be longer in the frigid zones than in the torrid: and the difference is found to be such as prove the earth's equatorial diameter to be 35 miles longer than its axis.—Since then, the earth is higher at the equator than at the poles, the sea, which like all other fluids naturally runs downward (or towards the places which are nearest the earth's centre) would run towards the polar regions, and leave the equatorial parts dry, if the centrifugal force of the water, which carried it to those parts, and so raised them, did not detain and keep it from running back again towards the poles of the earth.

#### *Of the Mechanical Powers.*

If we consider bodies in motion, and compare them together, we may do this either with respect to the quantities of matter they contain, or the velocities with which they are moved. The heavier any body is, the greater is the power required either to move it or to stop its motion: and again, the swifter it moves, the greater is its force. So that the whole *momentum* or quantity of force of a moving body is the result of its quantity of matter multiplied by the velocity with which it is moved. And when the products arising from the multiplication of the particular quantities of matter in any two bodies by their respective velocities are equal, the *momenta* or entire forces are so too. Thus, suppose a body, which we shall call A, to weigh 40 pounds, and to move at the rate of two miles in a minute; and another body, which we shall call B, to weigh only four pounds, and to move 20 miles in a minute; the entire forces with which these two bodies would strike against any obstacle would be equal to each other, and therefore it would require equal powers to stop them. For 40 multiplied by 2 gives 80, the force of the body A; and 20 multiplied by 4 gives 80, the force of the body B.

Upon this easy principle depends the whole of mechanics:

chanics: and it holds univerſally true, that when two bodies are ſuſpended by any machine, ſo as to act contrary to each other: if the machine be put into motion, and the perpendicular aſcent of one body multiplied into its weight, be equal to the perpendicular deſcent of the other body multiplied into its weight, theſe bodies, how unequal ſoever in their weights, will balance one another in all ſituations: for, as the whole aſcent of one is performed in the ſame time with the whole deſcent of the other, their reſpective velocities muſt be directly as the ſpaces they move through; and the exceſs of weight in one body is compensated by the exceſs of velocity in the other.—Upon this principle it is eaſy to compute the power of any mechanical engine, whether ſimple or compound; for it is but only inquiring how much ſwifter the power moves than the weight does (*i. e.* how much farther in the ſame time,) and juſt ſo much is the power increaſed by the help of the engine.

In the theory of this ſcience, we ſuppoſe all planes perfectly even, all bodies perfectly ſmooth, levers to have no weight, cords to be extremely pliable, machines to have no friction; and in ſhort, all imperfection muſt be ſet aſide until the theory be eſtabliſhed, and then proper allowances are to be made.

The ſimple machines, uſually called *mechanical powers*, are ſix in number, *viz.* the *lever*, the *wheel and axle*, the *pulley*, the *inclined plane*, the *wedge*, and the *ſcrew*. They are called mechanical powers, becauſe they help us to raiſe weights, move heavy bodies, and overcome reſiſtances, which we could not effect without them.

1. A *lever* is a bar of iron or wood, one part of which being ſupported by a prop, all the other parts turn upon that prop as their centre of motion: and the velocity of every part or point is directly as its diſtance from the prop. Therefore, when the weight to be raiſed at one end is to the power applied at the other to raiſe it, as the diſtance of the power from the prop is to the diſtance of the weight from the prop, the power and weight will exactly balance or counterpoize each other: and as a common lever has but very little friction on its prop, a very little additional power will be ſufficient to raiſe the weight.

There are four kinds of levers. 1. The common ſort, where the prop is placed between the weight and the power; but much nearer to the weight than to the power. 2. When the prop is at one end of the lever, the power at the other, and the weight between them. 3. When the prop is at one end, the weight at the other, and the power applied between them. 4. The bended lever, which differs only in form from the firſt ſort, but not in property. Thoſe of the firſt and ſecond kind are often uſed in mechanical engines; but there are few inſtances in which the third ſort is uſed.

A *common balance* is a lever of the firſt kind; but as both its ends are at equal diſtances from its centre of motion, they move with equal velocities; and therefore, as it gives no mechanical advantage, it cannot properly be reckoned among the mechanical powers.

A lever of the firſt kind is represented by the bar ABC, (Plate CVII. fig. 2.) ſupported by the prop D. Its principal uſe is to looſen large ſtones in the ground, or raiſe great weights to ſmall heights, in order to have

ropes put under them for raiſing them higher by other machines. The parts AB and BC, on different ſides of the prop D, are called the arms of the lever: the end A of the ſhorter arm AB being applied to the weight intended to be raiſed, or to the reſiſtance to be overcome; and the power applied to the end C of the longer arm BC.

In making experiments with this machine, the ſhorter arm AB muſt be as much thicker than the longer arm BC, as will be ſufficient to balance it on the prop. This ſuppoſed, let P represent a power whoſe intensity is equal to one ounce, and W a weight whoſe intensity is equal to 12 ounces. Then, if the power be 12 times as far from the prop as the weight is, they will exactly counterpoize; and a ſmall addition to the power P will cauſe it to deſcend, and raiſe the weight W; and the velocity with which the power deſcends will be to the velocity with which the weight riſes, as 12 to 1: that is, directly as their diſtances from the prop; and conſequently, as the ſpaces through which they move. Hence it is plain, that a man who by his natural ſtrength, without the help of any machine, could ſupport an hundred weight, will by the help of this lever be enabled to ſupport twelve hundred. If the weight be leſs, or the power greater, the prop may be placed ſo much the farther from the weight; and then it can be raiſed to a proportionably greater height. For univerſally, if the intensity of the weight multiplied into its diſtance from the prop be equal to the intensity of the power multiplied into its diſtance from the prop, the power and weight will exactly balance each other; and a little addition to the power will raiſe the weight. Thus, in the preſent inſtance, the weight W is 12 ounces, and its diſtance from the prop is 1 inch; and 12 multiplied by 1 is 12; the power P is equal to 1 ounce, and its diſtance from the prop is 12 inches, which multiplied by one is 12 again: and therefore there is an equilibrium between them. So, if a power equal to 2 ounces be applied at the diſtance of 6 inches from the prop, it will juſt balance the weight W; for 6 multiplied by 2 is 12, as before. And a power equal to 3 ounces placed at 4 inches diſtance from the prop would do the ſame; for 3 times 4 is 12; and ſo on, in proportion.

The *ſtatera*, or Roman *ſteelyard*, is a lever of this kind, contrived for finding the weights of different bodies by one ſingle weight placed at different diſtances from the prop or centre of motion D. For, if a ſcale hangs at A, the extremity of the ſhorter arm AB, and is of ſuch a weight as will exactly counterpoize the longer arm BC; if this arm be divided into as many equal parts as it will contain, each equal to AB, the ſingle weight P (which we may ſuppoſe to be 1 pound) will ſerve for weighing any thing as heavy as itſelf, or as many times heavier as there are diviſions in the arm BC, or any quantity between its own weight and that quantity. As for example, if P be 1 pound, and placed at the firſt diviſion 1 in the arm BC, it will balance 1 pound in the ſcale at A: if it be removed to the ſecond diviſion at 2, it will balance 2 pounds in the ſcale; if to the third, 3 pounds: and ſo on to the end of the arm BC. If each of theſe integral diviſions be ſubdivided into as many equal parts as a pound contains ounces, and the weight

P be placed at any of these subdivisions, so as to counterpoise what is in the scale, the pounds and odd ounces therein are by that means ascertained.

To this kind of lever may be reduced several sorts of instruments, such as scissars, pinchers, snuffers; which are made of two levers acting contrary to one another; their prop or centre of motion being the pin which keeps them together.

In common practice, the longer arm of this lever greatly exceeds the weight of the shorter; which gains great advantage, because it adds so much to the power.

A lever of the second kind has the weight between the prop and the power. In this, as well as the former, the advantage gained is as the distance of the power from the prop to the distance of the weight from the prop: for the respective velocities of the power and weight are in that proportion; and they will balance each other when the intensity of the power multiplied by its distance from the prop is equal to the intensity of the weight multiplied by its distance from the prop. Thus, if AB (fig. 3.) be a lever on which the weight W of 6 ounces hangs at the distance of 1 inch from the prop G, and a power P equal to the weight of one ounce hangs at the end B, 6 inches from the prop, by the cord CD going over the fixed pulley E, the power will just support the weight; and a small addition to the power will raise the weight 1 inch for every 6 inches that the power descends.

This lever shews the reason why two men carrying a burden upon a stick between them, bear unequal shares of the burden in the inverse proportion of their distances from it. For it is well known, that the nearer any of them is to the burden, the greater share he bears of it: and if he goes directly under it, he bears the whole. So, if one man be at G, and the other at P, having the pole or stick AB resting on their shouldets; if the burden or weight W be placed five times as near the man at G, as it is to the man at P, the former will bear five times as much weight as the latter. This is likewise applicable to the case of two horses of unequal strength, to be so yoked, as that each horse may draw a part proportionable to his strength; which is done by dividing the beam so, that the point of traction may be as much nearer to the stronger horse than to the weaker, as the strength of the former exceeds that of the latter.

To this kind of lever may be reduced oars, rudders of ships, doors turning upon hinges, cutting knives which are fixed at the point of the blade, and the like.

If in this lever we suppose the power and weight to change places, so that the power may be between the weight and the prop, it will become a lever of the third kind; in which, that there may be a balance between the power and the weight, the intensity of the power must exceed the intensity of the weight, just as much as the distance of the weight from the prop exceeds the distance of the power from it. Thus, let E (fig. 4.) be the prop of the lever AB, and W a weight of 1 pound, placed 3 times as far from the prop, as the power P acts at F, by the cord C going over the fixed pulley D; in this case, the power must be equal to three pounds, in order to support the weight.

To this sort of lever are generally referred the bones of a man's arm: for when we lift a weight by the hand, the muscle that exerts its force to raise that weight, is fixed to the bone about one tenth part as far below the elbow as the hand is. And the elbow being the centre round which the lower part of the arm turns, the muscle must therefore exert a force ten times as great as the weight that is raised.

As this kind of lever is a disadvantage to the moving power, it is never used but in cases of necessity; such as that of a ladder, which, being fixed at one end, is by the strength of a man's arms reared against a wall; and in clock-work, where all the wheels may be reckoned levers of this kind, because the power that moves every wheel, except the first, acts upon it near the centre of motion by means of a small pinion, and the resistance it has to overcome acts against the teeth round its circumference.

The fourth kind of lever differs nothing from the first, but in being bended for the sake of convenience. ACB (fig. 5.) is a lever of this sort, bended at C, which is its prop, or centre of motion. P is a power acting upon the longer arm AC at F, by means of the cord DE going over the pulley G; and W is a weight or resistance acting upon the end B of the shorter arm BC. If the power be to the weight as BC is to CF, they are in *equilibrio*. Thus, suppose W to be 5 pounds acting at the distance of one foot from the centre of motion C, and P to be 1 pound acting at F, five feet from the centre C, the power and weight will just balance each other. A hammer drawing a nail is a lever of this sort.

2. The second mechanical power is the *wheel and axle*, in which the power is applied to the circumference of the wheel, and the weight is raised by a rope which coils about the axle as the wheel is turned round. Here it is plain, that the velocity of the power must be to the velocity of the weight, as the circumference of the wheel is to the circumference of the axle: and consequently, the power and weight will balance each other, when the intensity of the power is to the intensity of the weight as the circumference of the axle is to the circumference of the wheel. Let AB (fig. 6.) be a wheel, CD its axle, and suppose the circumference of the wheel to be 8 times as great as the circumference of the axle; then a power P equal to 1 pound hanging by the cord I, which goes round the wheel, will balance a weight W of 8 pounds hanging by the rope K which goes round the axle. And as the friction on the pivots or gudgeons of the axle is but small, a small addition to the power will cause it to descend, and raise the weight: but the weight will rise with only an eighth part of the velocity wherewith the power descends, and consequently through no more than an eighth part of an equal space, in the same time. If the wheel be pulled round by the handles S, S, the power will be increased in proportion to their length. And by this means, any weight may be raised as high as the operator pleases.

To this sort of engine belong all cranes for raising great weights; and in this case, the wheel may have cogs all around it instead of handles, and a small lantern or trundle may be made to work in the cogs, and be turned

by a winch; which will make the power of the engine to exceed the power of the man who works it, as much as the number of revolutions of the winch exceed those of the axle D, when multiplied by the excess of the length of the winch above the length of the semidiameter of the axle, added to the semidiameter or half-thickness of the rope K, by which the weight is drawn up. Thus, suppose the diameter of the rope and axle taken together to be 12 inches, and consequently half their diameters to be 6 inches; so that the weight W will hang at 6 inches perpendicular distance from below the centre of the axle. Now, let us suppose the wheel AB, which is fixed on the axle, to have 80 cogs, and to be turned by means of a winch six inches long, fixed on the axis of a trundle of 8 staves or rounds, working in the cogs of the wheel.—Here it is plain, that the winch and trundle would make 10 revolutions for one of the wheel AB, and its axis D, on which the rope K winds in raising the weight W; and the winch being no longer than the sum of the semi-diameters of the great axle and rope, the trundle could have no more power on the wheel, than a man could have by pulling it round by the edge, because the winch would have no greater velocity than the edge of the wheel has, which we here suppose to be ten times as great as the velocity of the rising weight; so that, in this case, the power gained would be as 10 to 1. But if the length of the winch be 12 inches, the power gained will be as 20 to 1: if 18 inches (which is long enough for any man to work by) the power gained would be as 30 to 1; that is, a man could raise 30 times as much by such an engine, as he could do by his natural strength without it, because the velocity of the handle of the winch would be 30 times as great as the velocity of the rising weight; the absolute force of any engine being in proportion of the velocity of the power to the velocity of the weight raised by it.—But then, just as much power or advantage as is gained by the engine, so much time is lost in working it. In this sort of machines it is requisite to have a ratchet-wheel G on one end of the axle, with a catch H to fall into its teeth; which will at any time support the weight, and keep it from descending, if the workman should, through inadvertency or carelessness, quit his hold whilst the weight is raising. And by this means, the danger is prevented which might otherwise happen by the running down of the weight when left at liberty.

3 The third mechanical power or engine consists either of one *moveable pulley*, or a *system of pulleys*; some in a block or case which is fixed, and others in a block which is moveable, and rises with the weight. For tho' a single pulley, that only turns on its axis, and rises not with the weight, may serve to change the direction of the power, yet it can give no mechanical advantage thereto; but is only as the beam of a balance, whose arms are of equal length and weight. Thus, if the equal weights W and P (fig. 7.) hang by the cord BB upon the pulley A, whose block *b* is fixed to the beam HI, they will counterpoise each other, just in the same manner as if the cord were cut in the middle, and its two ends hung upon the hooks fixed in the pulley at A and A, equally distant from its centre.

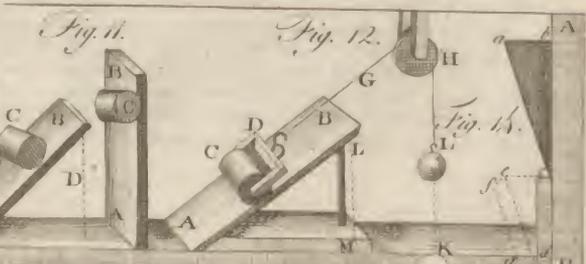
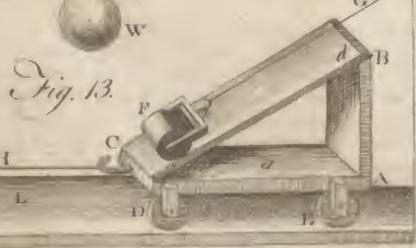
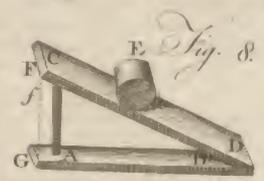
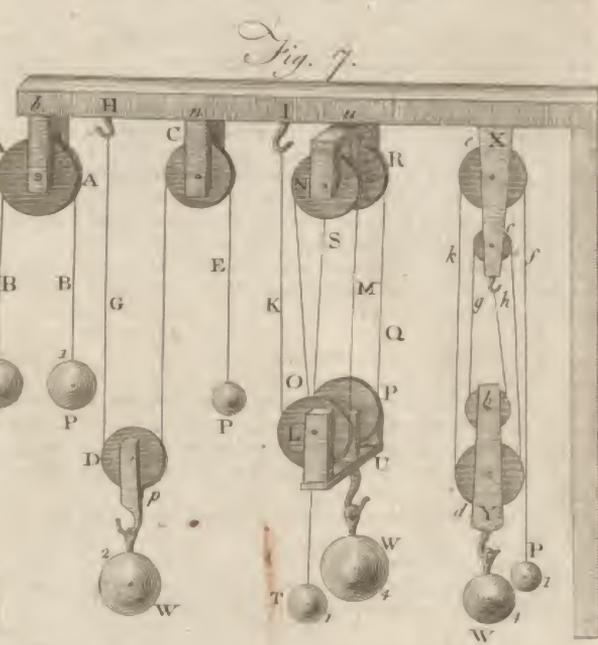
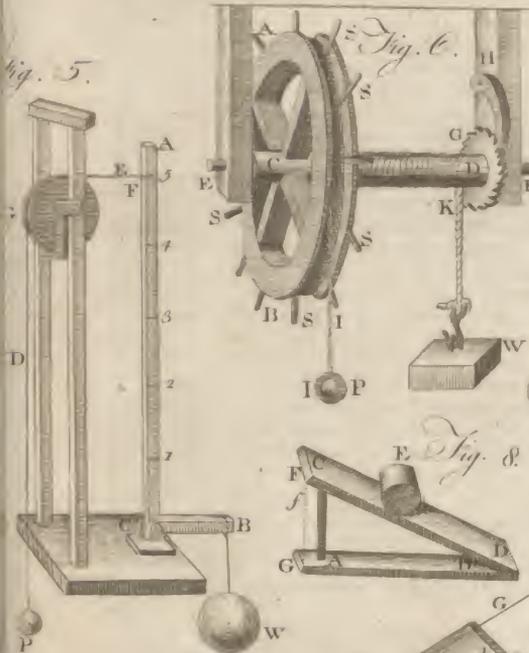
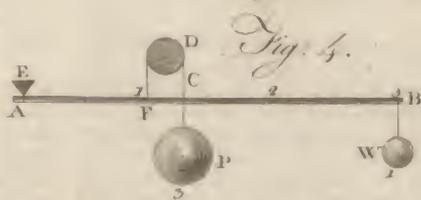
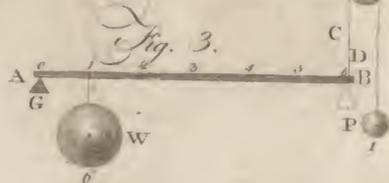
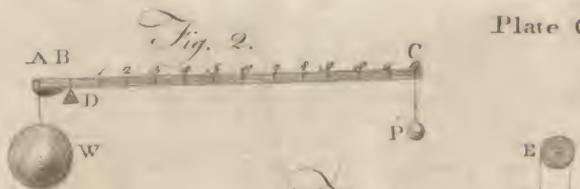
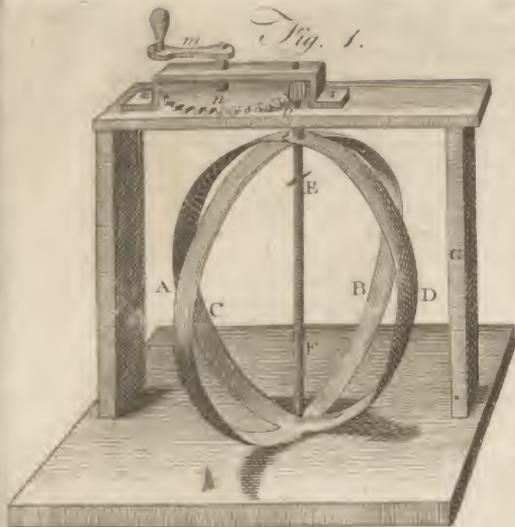
But if a weight W hangs at the lower end of the move-

able block *p* of the pulley D, and the cord GF goes under the pulley, it is plain that the half G of the cord bears one half of the weight W, and the half F the other; for they bear the whole between them. Therefore, whatever holds the upper end of either rope, sustains one half of the weight; and if the cord at F be drawn up so as to raise the pulley D to C, the cord will then be extended to its whole length, all but that part which goes under the pulley: and consequently, the power that draws the cord will have moved twice as far as the pulley D with its weight W rises: on which account, a power whose intensity is equal to one half of the weight will be able to support it, because if the power moves (by means of a small addition) its velocity will be double the velocity of the weight; as may be seen by putting the cord over the fixed pulley C (which only changes the direction of the power, without giving any advantage to it) and hanging on the weight P, which is equal only to one half of the weight W; in which case there will be an equilibrium, and a little addition to P will cause it to descend, and raise W through a space equal to one half of that through which P descends.—Hence, the advantage gained will be always equal to twice the number of pulleys in the moveable or undermost block. So that, when the upper or fixed block *u* contains two pulleys, which only turn on the axes, and the lower or moveable block U contains two pulleys, which not only turn upon their axes, but also rise with the block and weight; the advantage gained by this is as 4 to the working power. Thus, if one end of the rope KMOQ be fixed to a hook at I, and the rope passes over the pulleys N and R, and under the pulleys L and P, and has a weight T, of one pound, hung to its other end at T, this weight will balance and support a weight W of four pounds hanging by a hook at the moveable block U, allowing the said block as a part of the weight. And if as much more power be added as is sufficient to overcome the friction of the pulleys, the power will descend with four times as much velocity as the weight rises, and consequently through four times as much space.

The two pulleys in the fixed block X, and the two in the moveable block Y, are in the same case with those last mentioned; and those in the lower block give the same advantage to the power.

As a system of pulleys has not great weight and lies in a small compass, it is easily carried about: and can be applied, in a great many cases, for raising weights, where other engines cannot. But they have a great deal of friction, on three accounts: 1. Because the diameters of their axes bear a very considerable proportion to their own diameters; 2. Because in working they are apt to rub against one another, or against the sides of the block; 3. Because of the stiffness of the rope that goes over and under them.

4. The fourth mechanical power is the *inclined plane*; and the advantage gained by it is as great as its length exceeds its perpendicular height. Let AB (fig. 8.) be a plane parallel to the horizon, and CD a plane inclined to it; and suppose the whole length CD to be three times as great as the perpendicular height G/F: in this case, the cylinder E will be supported upon the plane CD, and kept





kept from rolling down upon it, by a power equal to a third part of the weight of the cylinder. Therefore, a weight may be rolled up this inclined plane with a third part of the power which would be sufficient to draw it up by the side of an upright wall. If the plane was four times as long as high, a fourth part of the power would be sufficient; and so on, in proportion. Or, if a pillar was to be raised from a floor to the height GF, by means of the engine ABDC, (which would then act as a half wedge, where the resistance gives way only on one side) the engine and pillar would be in *equilibrio* when the power applied at GF was to the weight of the pillar as GF to GD; and if the power be increased, so as to overcome the friction of the engine against the floor and pillar, the engine will be driven, and the pillar raised: and when the engine has moved its whole length upon the floor, the pillar will be raised to the whole height of the engine, from G to F.

The force wherewith a rolling body descends upon an inclined plane, is to the force of its absolute gravity, by which it would descend perpendicularly in a free space, as the height of the plane is to its length. For, suppose the plane AB (fig. 9.) to be parallel to the horizon, the cylinder C will keep at rest upon any part of the plane where it is laid. If the plane be so elevated, that its perpendicular height D (fig. 10.) is equal to half its length AB, the cylinder will roll down upon the plane with a force equal to half its weight; for it would require a power (acting on the direction of AB) equal to half its weight, to keep it from rolling. If the plane AB (fig. 11.) be elevated, so as to be perpendicular to the horizon, the cylinder C will descend with its whole force of gravity, because the plane contributes nothing to its support or hindrance; and therefore, it would require a power equal to its whole weight to keep it from descending.

Let the cylinder C (fig. 12.) be made to turn upon slender pivots in the frame D, in which there is a hook *e*, with a line G tied to it: let this line go over the fixed pulley H, and have its other end tied to a hook in the weight I. If the weight of the body I, be to the weight of the cylinder C, added to that of its frame D, as the perpendicular height of the plane LM is to its length AB, the weight will just support the cylinder upon the plane, and a small touch of a finger will either cause it to ascend or descend with equal ease: then, if a little addition be made to the weight I, it will descend, and draw the cylinder up the plane. In the time that the cylinder moves from A to B, it will rise through the whole height of the plane ML; and the weight will descend from H to K, through a space equal to the whole length of the plane AB.

If the plane be made to move upon rollers or friction-wheels, and the cylinder be supported upon it; the same power will draw the plane under the cylinder, which before drew the cylinder up the plane, provided the pivots of the axes of the friction-wheels be small, and the wheels themselves be pretty large. For, let the machine ABC (fig. 13.) (equal in length and height to ABM, fig. 12.) be provided with four wheels, whereof two appear at D and E, and the third under C, whilst the fourth is hid from sight by the horizontal board *a*. Let the cylinder

F be laid upon the lower end of the inclined plane CB, and the line G be extended from the frame of the cylinder, about six feet parallel to the plane CB; and, in that direction, fixed to a hook in the wall; which will support the cylinder, and keep it from rolling off the plane. Let one end of the line H be tied to a hook at C in the machine, and the other end to a weight K, the same as drew the cylinder up the plane before. If this line be put over the fixed pulley I, the weight K will draw the machine along the horizontal plane L, and under the cylinder F: and when the machine has been drawn the whole length CB, the cylinder will be raised to *d*, equal to the perpendicular height AB above the horizontal part at A.

To the inclined plane may be reduced all hatchets, chisels, and other edge tools which are chamfered only on one side.

5. The fifth mechanical power or engine is the *wedge*, which may be considered as two equally inclined planes DEF and CEF, joined together at their bases *e* EF: then DC (Plate CVIII. fig. 1.) is the whole thickness of the wedge at its back ABCD, where the power is applied; EF is the depth or height of the wedge; DF the length of one of its sides, equal to CF the length of the other side; and OF is its sharp edge, which is entered into the wood intended to be split by the force of a hammer or mallet striking perpendicularly on its back. Thus, AB $\delta$  (fig. 2.) is a wedge driven into the cleft CDE of the wood FG.

When the wood does not cleave at any distance before the wedge, there will be an equilibrium between the power impelling the wedge downward, and the resistance of the wood acting against the two sides of the wedge; if the power be to the resistance, as half the thickness of the wedge at its back is to the length of either of its sides; that is, as *Aa* to *Ab*, or *Ba* to *Bb* (fig. 2.) And if the power be increased, so as to overcome the friction of the wedge and the resistance arising from the cohesion or stickage of the wood, the wedge will be drove in, and the wood split asunder,

But, when the wood cleaves at any distance before the wedge (as it generally does) the power impelling the wedge will not be to the resistance of the wood, as half the thickness of the wedge is to the length of one of its sides; but as half its thickness is to the length of either side of the cleft, estimated from the top or acting part of the wedge. For, if we suppose the wedge to be lengthened down from *b* to the bottom of the cleft at *E*, the same proportion will hold; namely, that the power will be to the resistance, as half the thickness of the wedge is to the length of either of its sides: or, which amounts to the same thing, as the whole thickness of the wedge is to the length of both its sides.

In order to prove what is here advanced concerning the wedge, let us suppose the wedge to be divided lengthwise into two equal parts: and then it will become two equally inclined planes; one of which, as *abc*, (Plate CVII. fig. 14.) may be made use of as a half wedge for separating the moulding *cd* from the waincot AB. It is evident, that when this half-wedge has been driven its whole length *ac* between the waincot and moulding, its side *ac* will be at *ed*; and the moulding will be separated

to  $fg$  from the wainſcot. Now, from what has been already proved of the inclined plane, it appears, that to have an equilibrium between the power impelling the half-wedge and the reſiſtance of the moulding, the former muſt be to the latter as  $ab$  to  $ac$ ; that is, as the thickneſs of the back which receives the ſtroke is to the length of the ſide againſt which the moulding acts. Therefore, ſince the power upon the half wedge is to the reſiſtance againſt its ſide, as the half back  $ab$  is to the whole ſide  $ac$ , it is plain, that the power upon the whole wedge (where the whole back is double the half back) muſt be to the reſiſtance againſt both its ſides, as the thickneſs of the whole back is to the length of both the ſides, ſuppoſing the wedge at the bottom of the cleft; or as the thickneſs of the whole back to the length of both ſides of the cleft, when the wood ſplits at any diſtance before the wedge. For, when the wedge is driven quite into the wood, and the wood ſplits at ever ſo ſmall a diſtance before its edge, the top of the wedge then becomes the acting part, becauſe the wood does not touch it any where elſe. And ſince the bottom of the cleft muſt be conſidered as that part where the whole ſtroke or reſiſtance is accumulated, it is plain, from the nature of the lever, that the farther the power acts from the reſiſtance, the greater is the advantage.

Some writers have advanced, that the power of the wedge is to the reſiſtance to be overcome, as the thickneſs of the back of the wedge is to the length only of one of its ſides; which ſeems very ſtrange: for, if we ſuppoſe  $AB$  (Plate CVIII. fig. 3.) to be a ſtrong inflexible bar of wood or iron fixt into the ground at  $CB$ , and  $D$  and  $E$  to be two blocks of marble lying on the ground on oppoſite ſides of the bar, it is evident that the block  $D$  may be ſeparated from the bar to the diſtance  $d$ , equal to  $ab$ , by driving the inclined plane or half wedge  $abo$  down between them; and the block  $E$  may be ſeparated to an equal diſtance on the other ſide, in like manner, by the half wedge  $edo$ . But the power impelling each half wedge will be to the reſiſtance of the block againſt its ſide, as the thickneſs of that half wedge is to the length of its acting ſide. Therefore the power to drive both the half wedges is to both the reſiſtances, as both the half backs is to the length of both the acting ſides, or as half the thickneſs of the whole back is to the length of either ſide. And, if the bar be taken away, the blocks put cloſe together, and the two half wedges joined to make one; it will require as much force to drive it down between the blocks, as is equal to the ſum of the ſeparate powers acting upon the half wedges when the bar was between them.

To confirm this by an experiment, let two cylinders, as  $AB$  (fig. 4.) and  $CD$ , be drawn towards one another by lines running over fixed pulleys, and a weight of 40 ounces hanging at the lines belonging to each cylinder: and let a wedge of 40 ounces weight, having its back juſt as thick as either of its ſides is long, be put between the cylinders, which will then act againſt each ſide with a reſiſtance equal to 40 ounces, whiſt its own weight endeavours to bring it down and ſeparate them. And here, the power of the wedge's gravity impelling it downward, will be to the reſiſtance of both the cylinders againſt the wedge, as the thickneſs of the wedge is to the length of both its ſides; for there will then be an equilibrium between the weight

of the wedge and the reſiſtance of the cylinders againſt it, and it will remain at any height between them; requiring juſt as much power to puſh it upward as to pull it downward.—If another wedge of equal weight and depth with this, and only half as thick, be put between the cylinders, it will require twice as much weight to be hung at the ends of the lines which draw them together, to keep the wedge from going down between them. That is, a wedge of 40 ounces, whoſe back is only equal to half the length of one of its ſides, will require 80 ounces to each cylinder, to keep it in an equilibrium between them: and twice 80 is 160, equal to four times 40. So that the power will be always to the reſiſtance, as the thickneſs of the back of the wedge is to the length (not of its one ſide, but) of both its ſides.

The beſt way, though perhaps not the neateſt, for making a wedge with its appurtenances for ſuch experiments, is as follows. Let  $IKLM$  (fig. 4.) and  $LMNO$  be two flat pieces of wood, each about fifteen inches long and three or four in breadth, joined together by a hinge at  $LM$ ; and let  $P$  be a graduated arch of braſs, on which the ſaid pieces of wood may be opened to any angle not more than 60 degrees, and then fixt at the given angle by means of the two ſcrews  $a$  and  $b$ . Then,  $IKNO$  will repreſent the back of the wedge,  $LM$  its ſharp edge which enters the wood, and the outſides of the pieces  $IKLM$  and  $LMNO$  the two ſides of the wedge againſt which the wood acts in cleaving. By means of the ſaid arch, the wedge may be opened ſo as to adjust the thickneſs of its back in any proportion to the length of either of its ſides, but not to exceed that length: and any weight, as  $p$ , may be hung to the wedge upon the hook  $M$ , which weight, together with the weight of the wedge itſelf, may be conſidered as the impelling power; which is all the ſame in experiment, whether it be laid upon the back of the wedge to puſh it down, or hung to its edge to pull it down.—Let  $AB$  and  $CD$  be two wooden cylinders, each about two inches thick, where they touch the outſides of the wedge; and let their ends be made like two round flat plates, to keep the wedge from ſlipping off endwiſe between them. Let a ſmall cord with a loop on one end of it go over a pivot in the end of each cylinder, and the cords  $S$  and  $T$  belonging to the cylinder  $AB$  go over the fixt pulleys  $W$  and  $X$ , and be faſtened at their other ends to the bar  $wx$ , on which any weight, as  $Z$ , may be hung at pleaſure. In like manner, let the cords  $Q$  and  $R$  belonging to the cylinder  $BC$  go over the fixt pulleys  $U$  and  $V$  to the bar  $wv$ , on which a weight  $Y$  equal to  $Z$  may be hung. Theſe weights, by drawing the cylinders towards one another, may be conſidered as the reſiſtance of the wood acting equally againſt oppoſite ſides of the wedge; the cylinders themſelves being ſuſpended near and parallel to each other, by their pivots in loops on the lines  $E, F, G, H$ ; which lines may be fixed to hooks in the ceiling of the room. The longer theſe lines are, the better; and they ſhould never be leſs than four feet each. The further alſo the pulleys  $W, V$  and  $W, X$  are from the cylinders, the truer will the experiments be; and they may turn upon pins fixed into the wall.

In this machine, the weights  $Y$  and  $Z$ , and the weight  $p$ , may be varied at pleaſure, ſo as to be adjusted in proportion

portion of the length of the wedge's side to the thickness of its back; and when they are so adjusted, the wedge will be in *equilibrium* with the resistance of the cylinders.

The wedge is a very great mechanical power, since not only wood but even rocks can be split by it; which would be impossible to effect by the lever, wheel and axle, or pulley: for the force of the blow, or stroke, shakes the cohering parts, and thereby makes them separate the more easily.

6. The sixth and last mechanical power is the *screw*; which cannot properly be called a simple machine, because it is never used without the application of a lever or winch to assist in turning it: and then it becomes a compound engine of a very great force either in pressing the parts of bodies close together, or in raising great weights. It may be conceived to be made by cutting a piece of paper ABC (fig. 5) into the form of an inclined plane or half wedge, and then coiling it round a cylinder AB (fig. 6.) And here it is evident, that the winch E must turn the cylinder once round before the weight or resistance D can be moved from one spiral winding to another, as from *d* to *c*: therefore, as much as the circumference of a circle described by the handle of the winch is greater than the interval or distance between the spirals, so much is the force of the screw. Thus, supposing the distance between the spirals to be half an inch, and the length of the winch to be twelve inches; the circle described by the handle of the winch where the power acts will be 76 inches nearly, or about 152 half inches, and consequently 152 times as great as the distance between the spirals: and therefore, a power at the handle, whose intensity is equal to no more than a single pound, will balance 152 pounds acting against the screw; and as much additional force, as is sufficient to overcome the friction, will raise the 152 pounds; and the velocity of the power will be to the velocity of the weight, as 152 to 1. Hence it appears, that the longer the winch be made, and the nearer the spirals are to one another, so much the greater is the force of the screw.

A machine for shewing the force or power of the screw may be contrived in the following manner. Let the wheel C (fig. 7.) have a screw *ab* on its axis, working in the teeth of the wheel D, which suppose to be 48 in number. It is plain, that for every time the wheel C and screw *ab* are turned round by the winch A, the wheel D will be moved one tooth by the screw; and therefore, in 48 revolutions of the winch, the wheel D will be turned once round. Then, if the circumference of a circle described by the handle of the winch be equal to the circumference of a groove *e* round the wheel D, the velocity of the handle will be 48 times as great as the velocity of any given point in the groove. Consequently; if a line G (above number 48) goes round the groove *e*, and has a weight of 48 pounds hung to it below the pedestal EF, a power equal to one pound at the handle will balance and support the weight. To prove this by experiment, let the circumferences of the grooves of the wheels C and D be equal to one another; and then if a weight H of one pound be suspended by a line going round the groove of the wheel C, it will balance a weight of 48 pounds hanging by the line

G; and a small addition to the weight H will cause it to descend, and so raise up the other weight.

If the line G, instead of going round the groove *e* of the wheel D, goes round its axle I; the power of the machine will be as much increased, as the circumference of the groove *e* exceeds the circumference of the axle: which, supposing it to be six times, then one pound at H will balance 6 times 48, or 288 pounds hung to the line on the axle: and hence the power or advantage of this machine will be as 288 to 1. That is to say, a man, who by his natural strength could lift an hundred weight, will be able to raise 288 hundred, or  $14\frac{2}{3}$  ton weight by this engine.

But the following engine is still more powerful, on account of its having the addition of four pulleys: and in it we may look upon all the mechanical powers combined together, even if we take in the balance. For as the axis D (fig. 8.) of the bar AB is in its middle at C, it is plain that if equal weights are suspended upon any two pins equidistant from the axis C, they will counterpoise each other.—It becomes a lever by hanging a small weight P upon the pin *n*, and a weight as much heavier upon either of the pins *b, c, d, e, or f*, as is in proportion to the pins being so much nearer the axis. The wheel and axle FG is evident; so is the screw E, which takes in the inclined plane, and with it the half wedge. Part of a cord goes round the axle, the rest under the lower pulleys K, *m*, over the upper pulleys L, *n*, and then it is tied to a hook at *m* in the lower or moveable block, on which hangs the weight W.

In this machine, if the wheel F has 30 teeth, it will be turned once round in thirty revolutions of the bar AB, which is fixt on the axis D of the screw E: if the length of the bar is equal to twice the diameter of the wheel, the pins *a* and *n* at the ends of the bar will move 60 times as fast as the teeth of the wheel do: and consequently, one ounce at P will balance 60 ounces hung upon a tooth at *q* in the horizontal diameter of the wheel. Then, if the diameter of the wheel F is 10 times as great as the diameter of the axle G, the wheel will have 10 times the velocity of the axle; and therefore one ounce P at the end of the lever AC will balance 10 times 60 or 6000 ounces hung to the rope H which goes round the axle. Lastly, if four pulleys be added, they will make the velocity of the lower block K, and weight W, four times less than the velocity of the axle: and this being the last power in the machine, which is four times as great as that gained by the axle, it makes the whole power of the machine 4 times 600, or 2400. So that a man who could lift one hundred weight in his arms, by his natural strength, would be able to raise 2400 hundred weight by this engine.—But it is here as in all other mechanical cases; for the time lost is always as much as the power gained, because the velocity with which the power moves will ever exceed the velocity with which the weight rises, as much as the intensity of the weight exceeds the intensity of the power.

The friction of the screw itself is very considerable; and there are few compound engines, but what, upon account of the friction of the parts against one another,

will require a third part of more power to work them when loaded, than what is sufficient to constitute a balance between the weight and the power.

*Of Mills, Cranes, Wheel carriages, and the Engine for driving Piles.*

As these machines are so universally useful, it would be ridiculous to make any apology for describing them.

In a common *breast-mill*, where the fall of water may be about ten feet, AA (Plate CVIII. fig. 9.) is the great wheel, which is generally about 17 or 18 feet in diameter, reckoned from the outermost edge of any float-board at *a* to that of its opposite float at *b*. To this wheel the water is conveyed through a channel; and so, falling upon the wheel, turns it round.

On the axis BB of this wheel, and within the mill-house, is a wheel D, about 8 or 9 feet diameter, having 61 cogs, which turn a trundle E containing ten upright staves or rounds; and when these are the number of cogs and rounds, the trundle will make  $6\frac{1}{5}$  revolutions for one revolution of the wheel.

The trundle is fixt upon a strong iron axis called the spindle, the lower end of which turns in a brass foot, fixt at F, in the horizontal beam ST called the bridge-tree; and the upper part of the spindle turns in a wooden bush fixt into the nether millstone which lies upon beams in the floor YY. The top part of the spindle above the bush is square, and goes into a square hole in a strong iron cross *abcd* (see fig. 3.) called the rynd; under which, and close to the bush, is a round piece of thick leather upon the spindle, which it turns round at the same time as it does the rynd.

The rynd is let into grooves in the under surface of the running millstone G (fig. 2.) and so turns it round in the same time that the trundle E is turned round by the cog-wheel D. This millstone has a large hole quite through its middle, called the eye of the stone, through which the middle part of the rynd and upper end of the spindle may be seen; whilst the four ends of the rynd lie hid below the stone in their grooves.

The end T of the bridge-tree TS (which supports the upper millstone G upon the spindle) is fixed into a hole in the wall; and the end S is let into a beam QR called the brayer, whose end R remains fixt in a mortise; and its other end Q hangs by a strong iron rod P which goes through the floor YY, and has a screw-nut on its top at O; by the turning of which nut, the end Q of the brayer is raised or depressed at pleasure, and consequently the bridge-tree TS and upper millstone. By this means, the upper millstone may be set as close to the under one, or raised as high from it, as the miller pleases. The nearer the millstones are to one another, the finer they grind the corn; and the more remote from one another, the coarser.

The upper millstone G is inclosed in a round box H, which does not touch it any where; and is about an inch distant from its edge all around. On the top of this box stands a frame for holding the hopper *kk*, to which is hung the shoe I by two lines fastened to the hind-part of it, fixed upon hooks in the hopper, and by one end of the crook-string K fastened to the fore-part of it at *i*; the o-

ther end being twisted round the pin L. As the pin is turned one way, the string draws up the shoe closer to the hopper, and so lessens the aperture between them; and as the pin is turned the other way, it lets down the shoe, and enlarges the aperture.

If the shoe be drawn up quite to the hopper, no corn can fall from the hopper into the mill; if it be let a little down, some will fall; and the quantity will be more or less, according as the shoe is more or less let down. For the hopper is open at bottom, and there is a hole in the bottom of the shoe, not directly under the bottom of the hopper, but forwarder towards the end *i*, over the middle of the eye of the millstone.

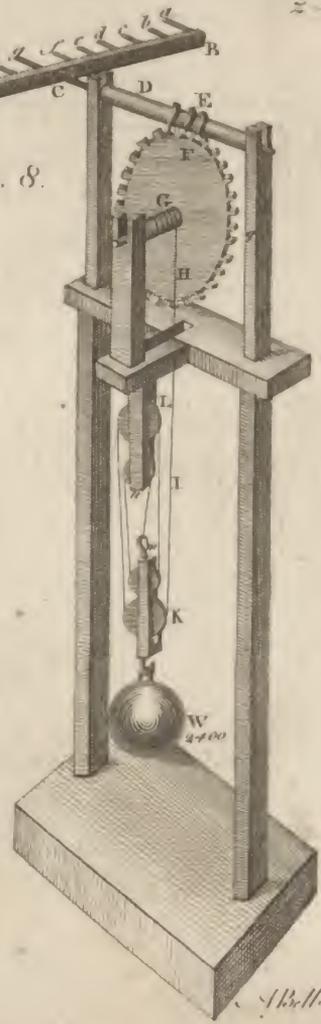
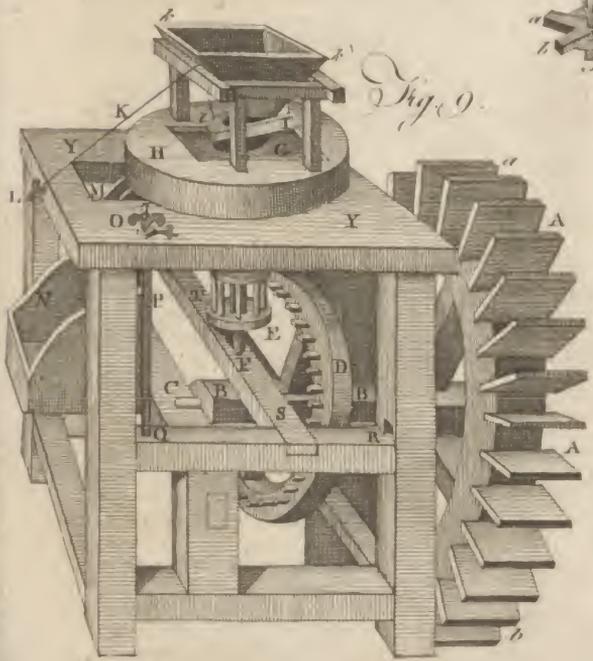
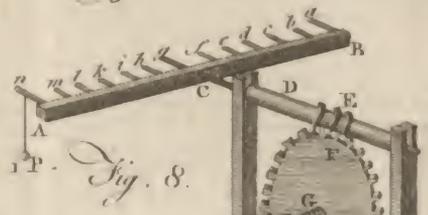
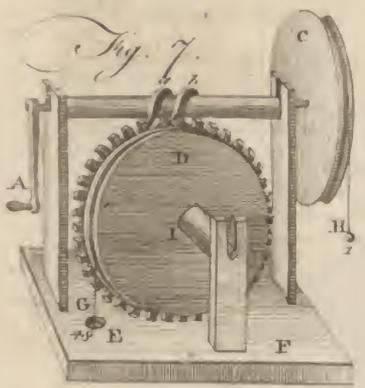
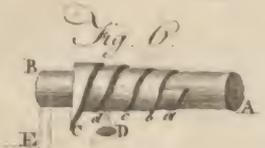
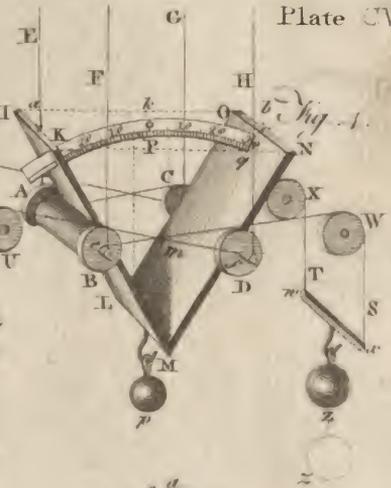
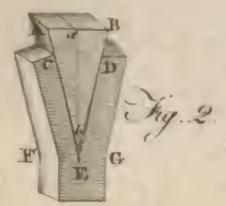
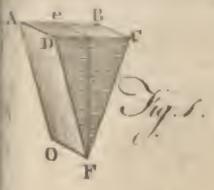
There is a square hole in the top of the spindle, in which is put the feeder *e* (fig. 10.) This feeder (as the spindle turns round) jogs the shoe three times in each revolution, and so causes the corn to run constantly down from the hopper, through the shoe, into the eye of the millstone, where it falls upon the top of the rynd, and is, by the motion of the rynd and the leather under it, thrown below the upper stone, and ground between it and the lower one. The violent motion of the stone creates a centrifugal force in the corn going round with it, by which means it gets farther and farther from the centre, as in a spiral, in every revolution, until it be thrown quite out; and, being then ground, it falls through a spout M, called the mill-eye, into the trough N.

When the mill is fed too fast, the corn bears up the stone, and is ground too coarse; and besides, it clogs the mill so as to make it go too slow. When the mill is too slowly fed, it goes too fast, and the stones by their attrition are apt to strike fire against one another. Both which inconveniencies are avoided by turning the pin L backwards or forwards, which draws up or lets down the shoe; and so regulates the feeding as the miller sees convenient.

The heavier the running millstone is, and the greater the quantity of water that falls upon the wheel, so much the faster will the mill bear to be fed; and consequently so much the more it will grind. And on the contrary, the lighter the stone, and the less the quantity of water, so much slower must the feeding be. But when the stone is considerably wore, and become light, the mill must be fed slowly at any rate; otherwise the stone will be too much borne up by the corn under it, which will make the meal coarse.

The quantity of power required to turn a heavy millstone is but a very little more than what is sufficient to turn a light one: for as it is supported upon the spindle by the bridge-tree ST, and the end of the spindle that turns in the brass foot therein being but small, the odds arising from the weight is but very inconsiderable in its action against the power or force of the water. And besides, a heavy stone has the same advantage as a heavy fly; namely, that it regulates the motion much better than a light one.

In order to cut and grind the corn, both the upper and under millstones have channels or furrows cut into them, proceeding obliquely from the centre towards the circumference. And these furrows are each cut perpendicularly on one side and obliquely on the other into the stone, which





which gives each furrow a sharp edge, and in the two stones they come, as it were, against one another like the edges of a pair of scissars: and so cut the corn, to make it grind the easier when it falls upon the places between the furrows. These are cut the same way in both stones when they lie upon their backs, which makes them run cross ways to each other when the upper stone is inverted by turning its furrowed surface towards that of the lower. For, if the furrows of both stones lay the same way, a great deal of the corn would be driven onward in the lower furrows, and so come out from between the stones without ever being cut.

When the furrows became blunt and shallow by wearing, the running stone must be taken up, and both stones new dressed with a chisel and hammer. And every time the stone is taken up, there must be some tallow put round the spindle upon the bush, which will soon be melted by the heat that the spindle acquires from its turning and rubbing against the bush, and so will get in betwixt them: otherwise the bush would take fire in a very little time.

The bush must embrace the spindle quite close, to prevent any shake in the motion; which would make some parts of the stones grate and fire against each other; whilst other parts of them would be too far asunder, and by that means spoil the meal in grinding.

Whenever the spindle wears the bush so as to begin to shake in it, the stone must be taken up, and a chisel drove into several parts of the bush; and when it is taken out, wooden wedges must be driven into the holes; by which means the bush will be made to embrace the spindle close all around it again. In doing this, great care must be taken to drive equal wedges into the bush on opposite sides of the spindle; otherwise it will be thrown out of the perpendicular, and so hinder the upper stone from being set parallel to the under one, which is absolutely necessary for making good work. When any accident of this kind happens, the perpendicular position of the spindle must be restored by adjusting the bridge-tree ST by proper wedges put between it and the brayer QR.

It often happens, that the rynd is a little wrenched in laying down the upper stone upon it; or is made to sink a little lower upon one side of the spindle than on the other; and this will cause one edge of the upper stone to drag all around upon the other, whilst the opposite edge will not touch. But this is easily set to rights, by raising the stone a little with a lever, and putting bits of paper, cards, or thin chips, betwixt the rynd and the stone.

The diameter of the upper stone is generally about six feet, the lower stone about an inch more: and the upper stone when new contains about  $2\frac{1}{2}$  cubic feet, which weighs somewhat more than 1000 pounds. A stone of this diameter ought never to go more than 60 times round in a minute; for if it turns faster, it will heat the meal.

The grinding surface of the under stone is a little convex from the edge to the centre, and that of the upper stone a little more concave: so that they are farthest from one another in the middle, and come gradually nearer towards the edges. By this means, the corn at

its first entrance between the stones is only bruised; but as it goes farther on towards the circumference or edge, it is cut smaller and smaller; and at last finely ground just before it comes out from between them.

The water-wheel must not be too large, for if it be, its motion will be too slow; nor too little, for then it will want power. And for a mill to be in perfection, the floats of the wheel ought to move with a third part of the velocity of the water, and the stone to turn round once in a second of time.

Such a mill as this, with a fall of water about  $7\frac{1}{2}$  feet, will require about 32 hogheads every minute to turn the wheel with a third part of the velocity with which the water falls, and to overcome the resistance arising from the friction of the geers and attrition of the stones in grinding the corn.

The greater fall the water has, the less quantity of it will serve to turn the mill. The water is kept up in the mill-dam, and let out by a sluice called the penstock, when the mill is to go. When the penstock is drawn up by means of a lever, it opens a passage through which the water flows to the wheel; and when the mill is to be stopt, the penstock is let down, which stops the water from falling upon the wheel.

A less quantity of water will turn an overshot-mill (where the wheel has buckets instead of float boards) than a breast-mill where the fall of the water seldom exceeds half the height AB of the wheel. So that, where there is but a small quantity of water, and a fall great enough for the wheel to lie under it, the bucket (or overshot) wheel is always used. But where there is a large body of water, with a little fall, the breast or float-board wheel must take place. Where the water runs only upon a little declivity, it can act but slowly upon the under part of the wheel at b; in which case the motion of the wheel will be very slow: and therefore, the floats ought to be very long, though not high, that a large body of water may act upon them; so that what is wanting in velocity may be made up in power; and then the cog-wheel may have a greater number of cogs in proportion to the rounds in the trundle, in order to give the millstone a sufficient degree of velocity.

They who have read what is said in the first section, concerning the acceleration of bodies falling freely by the power of gravity acting constantly and uniformly upon them, may perhaps ask, Why should the motion of the wheel be equable, and not accelerated, since the water acts constantly and uniformly upon it? The plain answer is, That the velocity of the wheel can never be so great as the velocity of the water that turns it; for, if it should become so great, the power of the water would be quite lost upon the wheel, and then there would be no proper force to overcome the friction of the geers and attrition of the stones. Therefore, the velocity with which the wheel begins to move, will increase no longer than till its *momentum* or force is balanced by the resistance of the machine; and then the wheel will go on with an equable motion.

[If the cog-wheel D be made about 18 inches diameter, with 30 cogs, the trundle as small in proportion with 10 staves, and the millstones be each about two feet in diameter, and the whole work be put into a strong frame of wood,

as represented in the figure, the engine will be a hand-mill for grinding corn or malt in private families. And then, it may be turned by a winch, instead of the wheel AA; the millstone making three revolutions for every one of the winch. If a heavy fly be put upon the axle B, near the winch, it will help to regulate the motion.]

If the cogs of the wheel and rounds of the trundle could be put in as exactly as the teeth are cut in the wheels and pinions of a clock, then the trundle might divide the wheel exactly; that is to say, the trundle might make a given number of revolutions for one of the wheel, without a fraction. But as any exact number is not necessary in mill-work, and the cogs and rounds cannot be set in so truly as to make all the intervals between them equal; a skilful mill-wright will always give the wheel what he calls a *hunting cog*; that is, one more than what will answer to an exact division of the wheel by the trundle. And then, as every cog comes to the trundle, it will take the next staff or round behind the one which it took in the former revolution: and by that means, will wear all the parts of the cogs and rounds which work upon one another equally, and to equal distances from one another in a little time; and so make a true uniform motion throughout the whole work. Thus, in the above water-mill, the trundle has 10 staves, and the wheel 61 cogs.

Sometimes, where there is a sufficient quantity of water, the cog-wheel AA (Plate CIX. fig. 1.) turns a large trundle BB, on whose axis C is fixed the horizontal wheel D, with cogs all round its edge, turning two trundles E and F at the same time; whose axes or spindles G and H turn two millstones I and K, upon the fixed stones L and M. And when there is not work for them both, either may be made to lie quiet, by taking out one of the staves of its trundle, and turning the vacant place towards the cog-wheel D. And there may be a wheel fixt on the upper end of the great upright axle C for turning a couple of boulting-mills, and other work for drawing up the sacks, fanning and cleaning the corn, sharpening of tools, &c.

If, instead of the cog-wheel AA and trundle BB, horizontal levers be fixed into the axle C, below the wheel D; then, horses may be put to these levers for turning the mill; which is often done where water cannot be had for that purpose.

The working parts of a wind-mill differ very little from those of a water mill; only the former is turned by the action of the wind upon four sails, every one of which ought (as is generally believed) to make an angle of  $54\frac{1}{2}$  degrees with a plane perpendicular to the axis on which the arms are fixt for carrying them; it being demonstrable, that when the sails are set to such an angle, and the axis turned end-ways toward the wind, the wind has the greatest power upon the sails. But this angle answers only to the case of a vane or sail just beginning to move: for, when the vane has a certain degree of motion, it yields to the wind; and then that angle must be increased to give the wind its full effect.

Again, the increase of this angle should be different, according to the different velocities from the axis to the extremity of the vane. At the axis it should be  $54\frac{1}{2}$  degrees, and thence continually increase, giving the vane a

twist, and so causing all the ribs of the vane to lie in different planes.

Lastly, these ribs ought to decrease in length from the axis to the extremity, giving the vane a curvilinear form; so that no part of the force of any one rib be spent upon the rest, but all move on independent of each other. All this is required to give the sails of a wind-mill their true form: and we see both the twist and the diminution of the ribs exemplified in the wings of birds.

It is almost incredible to think with what velocity the tips of the sails move when acted upon by a moderate gale of wind. We have several times counted the number of revolutions made by the sails in ten or fifteen minutes; and from the length of the arms from tip to tip, have computed, that if a hoop of that diameter was to run upon the ground with the same velocity that it would move if put upon the sail-arms, it would go upwards of 30 miles in an hour.

As the ends of the sails nearest the axis cannot move with the same velocity that the tips or farthest ends do, although the winds act equally strong upon them; perhaps a better position than that of stretching them along the arms directly from the centre of motion, might be to have them set perpendicularly across the farther ends of the arms, and there adjusted lengthwise to the proper angle. For, in that case, both ends of the sails would move with the same velocity; and being farther from the centre of motion, they would have so much the more power: and then, there would be no occasion for having them so large as they are generally made, which would render them lighter, and consequently there would be so much the less friction on the thick neck of the axle where it turns in the wall.

A *crane* is an engine by which great weights are raised to certain heights, or let down to certain depths. It consists of wheels, axles, pulleys, ropes, and a gib or gibbet. When the rope H (fig. 2.) is hooked to the weight K, a man turns the winch A, on the axis whereof is the trundle B, which turns the wheel C, on whose axis D is the trundle E, which turns the wheel F with its upright axis G, on which the great rope HH winds as the wheel turns; and going over a pulley I at the end of the arm *d* of the gib *acde*, it draws up the heavy burden K, which being raised to a proper height, as from a ship to the quay, is then brought over the quay by pulling the wheel Z round by the handles *z, z*, which turns the gib by means of the half wheel *b* fixt on the gib-post *cc*, and the strong pinion *a* fixt on the axis of the wheel Z. This wheel gives the man that turns it an absolute command over the gib, so as to prevent it from taking any unlucky swing, such as often happens when it is only guided by a rope tied to its arm *d*; and people are frequently hurt, sometimes killed, by such accidents.

The great rope goes between two upright upright rollers *i* and *k*, which turn upon gudgeons in the fixed beams *f* and *g*: and as the gib is turned towards either side, the rope bends upon the roller next that side. Were it not for these rollers, the gib would be quite unmanageable; for the moment it were turned ever so little towards any side, the weight K would begin to descend, because the rope would be shortened between the pulley

I and axis G; and so the gib would be pulled violently to that side, and either be broken to pieces, or break every thing that came in its way. These rollers must be placed so, that the sides of them, round which the rope bends, may keep the middle of the bended part directly even with the centre of the hole in which the upper gudgeon of the gib turns in the beam *f*. The truer these rollers are placed, the easier the gib is managed, and the less apt to swing either way by the force of the weight K.

A ratchet-wheel Q is fixt upon the axis D, near the trundle E; and unto this wheel falls the catch or click R. This hinders the machine from running back by the weight of the burden K, if the man who raises it should happen to be careless, and so leave off working at the winch A sooner than he ought to do.

When the burden K is raised to its proper height from the ship, and brought over the quay by turning the gib about, it is let down gently upon the quay, or into a cart standing thereon, in the following manner: A man takes hold of the rope *u* (which goes over the pulley *v*, and is tied to a hook at S in the catch R) and so disengages the catch from the ratchet-wheel Q; and then, the man at the winch A turns it backward, and lets down the weight K. But if the weight pulls too hard against this man, another lays hold of the handle V, and by pulling it downward, draws the gripe U close to the wheel Y, which, by rubbing hard against the gripe, hinders the too quick descent of the weight; and not only so, but even stops it at any time, if required. By this means, heavy goods may be either raised or let down at pleasure, without any danger of hurting the men who work the engine.

When part of the goods are craned up, and the rope is to be let down for more, the catch R is first disengaged from the ratchet-wheel Q, by pulling the cord *t*; then the handle *q* is turned half round backward, which, by the crank *nn* in the piece *o*, pulls down the frame *b* between the guides *m* and *m* (in which it slides in a groove) and so disengages the trundle B from the wheel C: and then, the heavy hook  $\beta$  at the end of the rope H descends by its own weight, and turns back the great wheel F with its trundle E, and the wheel C; and this last wheel acts like a fly against the wheel E and hook  $\beta$ , and so hinders it from going down too quick; whilst the weight X keeps up the gripe U from rubbing against the wheel Y, by means of a cord going from the weight, over the pulley *w* to the hook W in the gripe; so that the gripe never touches the wheel, unless it be pulled down by the handle V.

When the crane is to be set to work again, for drawing up another burden, the handle *q* is turned half round forwards: which, by the crank *nn*, raises up the frame *b*, and causes the trundle B to lay hold of the wheel C; and then, by turning the winch A, the burden of goods K is drawn up as before.

The crank *nn* turns pretty stiff in the mortise near *o*, and stops against the farther end of it when it has got just a little beyond the perpendicular; so that it can never come back of itself: and therefore the trundle B can never come away from the wheel C, until the handle *q* be turned half round.

The great rope runs upon rollers in the lever LM,  
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which keep it from bending between the axle at G and the pulley I. This lever turns upon the axis N by means of the weight O, which is just sufficient to keep its end L up to the rope; so that, as the great axle turns, and the rope coils round it, the lever rises with the rope, and prevents the coilings from going over one another.

The power of this crane may be estimated thus: Suppose the trundle B to have 13 staves or rounds, and the wheel C to have 78 spur cogs; the trundle E to have 14 staves, and the wheel F 56 cogs: then, by multiplying the staves of the trundles, 13 and 14, into one another, their product will be 182; and by multiplying the cogs of the wheels, 78 and 56, into one another, their product will be 4368; and dividing 4368 by 182, the quotient will be 24; which shews that the winch A makes 24 turns for one turn of the wheel F and its axle G on which the great rope or chain H H winds. So that, if the length or radius of the winch A were only equal to half the diameter of the great axle G, added to half the thickness of the rope H; the power of the crane would be as 24 to 1: but the radius of the winch being double the above length, it doubles the said power, and so makes it as 48 to 1: in which case a man may raise 48 times as much weight by this engine as he could do by his natural strength without it, making proper allowance for the friction of the working parts. — Two men may work at once, by having another winch on the opposite end of the axis of the trundle under B; and so make the power still double.

If this power be thought greater than what may be generally wanted, the wheels may be made with fewer cogs in proportion to the staves in the trundles: and so the power may be of whatever degree is judged to be requisite. But if the weight be so great as will require yet more power to raise it (suppose a double quantity) then the rope H may be put under a moveable pulley, as *s*, and the end of it tied to a hook in the gib at *e*; which will give a double power to the machine, and so raise a double weight hooked to the block of the moveable pulley.

When only small burdens are to be raised, this may be quickly done by men pushing the axle G round by the hand-spokes *y, y, y*; having first disengaged the trundle B from the wheel C: and then, this wheel will only act as a fly upon the wheel F; and the catch R will prevent its running back, if the men should inadvertently leave off pushing before the burden be unhooked from  $\beta$ .

Lastly, when very heavy burdens are to be raised, which might endanger the breaking of the cogs in the wheel F; their force against these cogs may be much abated by men pushing round the hand-spokes *y, y, y*, whilst the man at A turns the winch.

We have only shewn the working parts of this crane, without the whole of the beams which support them; knowing that these are easily supposed, and that if they had been drawn, they would have hid a great deal of the working parts from sight, and also confused the figure.

Another very good crane is made in the following manner. AA (fig 3.) is a great wheel turned by men walking within it at H. On the part C, of its axle BC, the great rope D is wound as the wheel turns; and this  
O rope

rope draws up goods in the same way as the rope HH does in the above-mentioned crane, the gib-work here being supposed to be of the same sort. But these cranes are very dangerous to the men in the wheel; for, if any of the men should chance to fall, the burden will make the wheel run back and throw them all about within it; which often breaks their limbs, and sometimes kills them. The late ingenious Mr *Padmore* of Bristol, whose contrivance the forementioned crane is, observing this dangerous construction, contrived a method for remedying it, by putting cogs all around the outside of the wheel, and applying a trundle E to turn it; which increases the power as much as the number of cogs in the wheel is greater than the number of staves in the trundle: and by putting a ratchet-wheel F on the axis of the trundle, (as in the above-mentioned crane, with a catch to fall into it, the great wheel is stopt from running back by the force of the weight, even if all the men in it should leave off walking. And by one man working at the winch I, or two men at the opposite winches when needful, the men in the wheel are much assisted, and much greater weights are raised, than could be by men only within the wheel. Mr. *Padmore* put also a gripe-wheel G upon the axis of the trundle, which being pinched in the same manner as described in the former crane, heavy burdens may be let down without the least danger. And before this contrivance, the lowering of goods was always attended with the utmost danger to the men in the wheel; as every one must be sensible of, who has seen such engines at work.

And it is surprising that the masters of wharfs and cranes should be so regardless of the limbs, or even lives of their workmen, that, excepting the late Sir *James Creed* of Greenwich, and some gentlemen at Bristol, there is scarce an instance of any who has used this safe contrivance.

THE structure of wheel-carriages is generally so well known, that it would be needless to describe them. And therefore, we shall only point out some inconveniencies attending the common method of placing the wheels, and loading the waggons.

In coaches, and all other four-wheeled carriages, the fore-wheels are made of a less size than the hind ones, both on account of turning short, and to avoid cutting the braces: otherwise, the carriage would go much easier if the fore-wheels were as high as the hind ones; and the higher the better, because their motion would be so much the slower on their axles, and consequently the friction proportionably taken off. But carriers and coachmen give another reason for making the fore-wheels much lower than the hind-wheels; namely, that when they are so, the hind-wheels help to push on the fore ones: which is too unphilosophical and absurd to deserve a reutation; and yet for their satisfaction, we shall shew by experiment that it has no existence but in their own imaginations.

It is plain, that the small wheels must turn as much oftener round than the great ones, as their circumferences are less. And therefore, when the carriage is loaded equally heavy on both axles, the fore-axle must endure as much more friction, and consequently wear out

as much sooner, than the hind-axle, as the fore-wheels are less than the hind ones. But the great misfortune is, that all the carriers to a man do obstinately persist, against the clearest reason and demonstration, in putting the heavier part of the load upon the fore-axle of the waggon; which not only makes the friction greatest where it ought to be least, but also presseth the fore-wheels deeper into the ground than the hind wheels, notwithstanding the fore-wheels, being less than the hind ones, are with so much the greater difficulty drawn out of a hole or over an obstacle, even supposing the weights on their axles were equal. For the difficulty, with equal weights, will be as the depth of the hole or height of the obstacle is to the semidiameter of the wheel. Thus, if we suppose the small wheel D (fig. 4.) of the waggon AB to fall into a hole of the depth EF, which is equal to the semidiameter of the wheel, and the waggon to be drawn horizontally along; it is evident, that the point E of the small wheel will be drawn directly against the top of the hole; and therefore, all the power of horses and men will not be able to draw it out, unless the ground gives way before it. Whereas, if the hind wheel C falls into such a hole, it sinks not near so deep in proportion to its semidiameter; and therefore, the point G of the large wheel will not be drawn directly, but obliquely, against the top of the hole; and so will be easily got out of it. Add to this, that since a small wheel will often sink to the bottom of a hole, in which a great wheel will go but a very little way, the small wheels ought in all reason to be loaded with less weight than the great ones; and then the heavier part of the load would be less jolted upward and downward, and the horses tired so much the less as their draught raised the load to less heights.

It is true, that when the waggon road is much up hill, there may be danger in loading the hind part much heavier than the fore part; for then the weight would overhang the hind axle, especially if the load be high, and endanger tilting up the fore-wheels from the ground. In this case, the safest way would be to load it equally heavy on both axles; and then, as much more of the weight would be thrown upon the hind-axle than upon the fore one, as the ground rises from a level below the carriage. But as this seldom happens, and when it does, a small temporary weight laid upon the pole between the horses would overbalance the danger; and this weight might be thrown into the waggon when it comes to level ground; it is strange that an advantage so plain and so obvious as would arise from loading the hind-wheels heaviest, should not be laid hold of, by complying with this method.

To confirm these reasonings by experiment, let a small model of a waggon be made, with its fore-wheels  $2\frac{1}{2}$  inches in diameter, and its hind-wheels  $4\frac{1}{2}$ ; the whole model weighing about 20 ounces. Let this little carriage be loaded any how with weights, and have a small cord tied to each of its ends, equally high from the ground it rests upon; and let it be drawn along a horizontal board, first by a weight in a scale hung to the cord at the fore part; the cord going over a pulley at the end of the board to facilitate the draught, and the weight just sufficient to draw it along. Then, turn the carriage, and hang the scale and weight to the hind cord, and it will

be

be found to move along with the same velocity as at first: which shews, that the power required to draw the carriage is all the same, whether the great or small wheels are foremost; and therefore the great wheels do not help in the least to push on the small wheels in the road.

Hang the scale to the fore cord, and place the fore-wheels (which are the small ones) in two holes, cut three eighth-parts of an inch deep into the board; then put a weight of 32 ounces into the carriage, over the fore-axle, and an equal weight over the hind one: this done, put 44 ounces into the scale, which will be just sufficient to draw out the fore-wheels: but if this weight be taken out of the scale, and one of 16 ounces put into its place, if the hind-wheels are placed in the holes, the 16 ounces weight will draw them out; which is little more than a third part of what was necessary to draw out the fore-wheels. This shews, that the larger the wheels are, the less power will draw the carriage, especially on rough ground.

Put 64 ounces over the axle of the hind-wheels, and 32 over the axle of the fore ones, in the carriage; and place the fore-wheels in the holes: then, put 38 ounces into the scale, which will just draw out the fore-wheels; and when the hind ones come to the hole, they will find but very little resistance, because they sink but a little way into it.

But shift the weights in the carriage, by putting the 32 ounces upon the hind axle, and the 64 ounces upon the fore one; and place the fore wheels in the holes; then, if 76 ounces be put into the scale, it will be found no more than sufficient to draw out these wheels; which is double the power required to draw them out, when the lighter part of the load was put upon them: which is a plain demonstration of the absurdity of putting the heaviest part of the load in the fore part of the waggon.

Every one knows what an outcry was made by the generality, if not the whole body, of the carriers, against the broad-wheel act; and how hard it was to persuade them to comply with it, even though the government allowed them to draw with more horses, and carry greater loads, than usual. Their principal objection was, that as a broad wheel must touch the ground in a great many more points than a narrow wheel, the friction must of course be just so much the greater; and consequently, there must be so many more horses than usual, to draw the waggon. It is believed that the majority of people were of the same opinion, not considering, that if the whole weight of the waggon and load in it bears upon a great many points, each sustains a proportionably less degree of weight and friction, than when it bears only upon a few points; so that what is wanting in one, is made up in the other; and therefore will be just equal under equal degrees of weight, as may be shewn by the following plain and easy experiment.

Let one end of a piece of packthread be fastened to a brick, and the other end to a common scale for holding weights: then, having laid the brick edgewise on a table, and let the scale hang under the edge of the table, and as much weight into the scale as will just draw the brick along the table. Then taking back the brick to its former place, lay it flat on the table, and leave it to be act-

ed upon by the same weight in the scale as before, which will draw it along with the same ease as when it lay upon its edge. In the former case, the brick may be considered as a narrow wheel on the ground; and in the latter, as a broad wheel. And since the brick is drawn along with equal ease, whether its broad side or narrow edge touches the table, it shews that a broad wheel might be drawn along the ground with the same ease as a narrow one (supposing them equally heavy) even though they should drag, and not roll, as they go along.

As narrow wheels are always sinking into the ground, especially when the heaviest part of the load lies upon them, they must be considered as going constantly up hill, even on level ground; and their edges must sustain a great deal of friction by rubbing against the sides of the ruts made by them. But both these inconveniences are avoided by broad wheels; which, instead of cutting and ploughing up the roads, roll them smooth, and harden them; as experience testifies in places where they have been used, especially either on wetish or sandy ground: though after all it must be confessed, that they will not do in stiff clayey cross-roads; because they would soon gather up as much clay as would be almost equal to the weight of an ordinary load.

If the wheels were always to go upon smooth and level ground, the best way would be to make the spokes perpendicular to the naves; that is, to stand at right angles to the axles; because they would then bear the weight of the load perpendicularly, which is the strongest way for wood. But because the ground is generally uneven, one wheel often falls into a cavity or rut when the other does not; and then it bears much more of the weight than the other does: in which case, concave or dishing wheels are best; because when one falls into a rut, and the other keeps upon high ground, the spokes become perpendicular in the rut, and therefore have the greatest strength when the obliquity of the load throws most of its weight upon them; whilst those on the high ground have less weight to bear, and therefore need not be at their full strength. So that the usual way of making the wheels concave is by much the best.

The axles of the wheels ought to be perfectly straight, that the rims of the wheels may be parallel to each other; for then they will move easiest, because they will be at liberty to go on straight forwards. But in the usual way of practice, the axles are bent downward at their ends; which brings the sides of the wheels next the ground nearer to one another than their opposite or higher sides are: and this not only makes the wheels to drag sidewise as they go along, and gives the load a much greater power of crushing them than when they are parallel to each other, but also endangers the overturning of the carriage when any wheel falls into a hole or rut; or when the carriage goes in a road which has one side lower than the other, as along the side of a hill. Thus (in the hind view of a waggon or cart) let AE and BF (fig. 5.) be the great wheels parallel to each other, on their straight axle K, and HCI the carriage loaded with heavy goods from C to G. Then, as the carriage goes on in the oblique road A'B, the centre of gravity of the whole machine and load will be at C (see p. 35. col. 1.) and the  
line

line of direction  $CdD$  falling within the wheel  $BF$ , the carriage will not overfet. But if the wheels be inclined to each other at the ground, as  $AE$  and  $BF$  (fig. 6.) are, and the machine be loaded as before, from  $C$  to  $G$ , the line of direction  $CdD$  falls without the wheel  $BF$ , and the whole machine tumbles over. When it is loaded with heavy goods (such as lead or iron) which lie low, it may travel safely upon an oblique road so long as the centre of gravity is at  $C$ , and the line of direction  $Cd$  (fig. 5.) falls within the wheels; but if it be loaded high with lighter goods (such as woolpacks) from  $C$  to  $L$ , (fig. 7.) the centre of gravity is raised from  $C$  to  $K$ , which throws the line of direction  $Kk$  without the lowest edge of the wheel  $BF$ , and then the load overfets the waggon.

If there be some advantage from small fore-wheels, on

account of the carriage turning more easily and short than it can be made to do when they are large; there is at least as great a disadvantage attending them, which is, that as their axle is below the level of the horses' breasts, the horses not only have the loaded carriage to draw along, but also part of its weight to bear; which tires them sooner, and makes them grow much stiffer in their hams, than they would be if they drew on a level with the fore axle: and for this reason, we find coach-horses soon become unfit for riding. So that on all accounts it is plain, that the fore-wheels of all carriages ought to be so high, as to have their axles even with the breasts of the horses; which would not only give the horses a fair draught, but likewise cause the machine to be drawn by a less degree of power.

## M E D

**MECHLIN**, a large well built and fortified city of Brabant, twelve miles north east of Brussels.

**MECHOACAN**, a province of Mexico, bounded by Panuco, on the north; by Mexico Proper, on the east; by the Pacific ocean, on the south; and by Guadalupe, or New Galicia, on the west.

**MECKLENBURG DUCHY**, a province of Germany, in the province of Lower Saxony, about 100 miles long, and 60 broad; bounded by the Baltic sea, on the north; by Pomerania, on the east; by Brandenburg, on the south; and by the duchies of Holstein, Lunenburg, and Lawenburg, on the west.

**MECON**, a great river, which rises in the north of further India, and, running south through the kingdoms of Laos and Cambodia, falls into the Indian ocean.

**MECONIUM**, in medicine, a black thick fæces gathered in the intestines of infants, and brought with them into the world at the time of their birth.

**MECONIUM**, in pharmacy, the extract of English poppies.

Meconium has all the virtues of the foreign opium, but in a somewhat lower degree. See **OPIMUM**.

**MEDAL**, a piece of metal in the form of coin, intending to convey to posterity the portrait of some great person, or the memory of some illustrious action.

The parts of a medal are the two sides, one of which is called the face or head, and the other the reverse. On each side is the area, or field, which makes the middle of the medal; the rim, or border; and the exergum: and one the two sides are distinguished the type or the figure represented, and the legend or inscription.

As to the antiquity of medals, the Greek are certainly the most ancient; for long before the building of Rome the Greeks had beautiful money in gold, silver, and copper. This plainly appears from several genuine medals of Macedon, older than Philip and Alexander; from Greek medals with the names of several magistrates prior to the Macedonian empire; to which we may add some Sicilian coins of still greater antiquity. As the Greek medals are the most ancient, so are they

## M E D

the most beautiful; they have a design, accuracy, force, and delicacy, that expresses even the muscles and veins, and are struck with such exquisite art, as the Romans could never come up to. Those struck when Rome was governed by consuls, are the most ancient among the Romans: but the copper and silver medals do not go beyond the 484th year of Rome, nor the gold beyond the year 546. Among the imperial medals, we distinguish between the upper and lower empire: the first commenced under Julius Cæsar, and ended A. D. about 260; the lower empire includes near 1200 years, and ends at the taking of Constantinople. It is the custom, however, to account all the imperial medals till the time of the Paleologi, among the antique; though we have none of any considerable beauty later than the time of Heraclius, who died in 641. The Gothic medals make part of the imperial ones. Modern medals are those struck within these 300 years. There are no true Hebrew medals, except a few shekels of copper and silver, but none of gold; though there is mention made of one in the king of Denmark's cabinet.

There was formerly no difference between money and medals. An old Roman had his purse full of the same pieces that we now preserve in cabinets. As soon as an emperor had done any thing remarkable, as gaining a victory, giving up a tax, or the like, it was immediately stamped on a coin, and became current thro' his whole dominions. This was a pretty device to spread abroad the virtues of an emperor, and make his actions circulate; and thus a fresh coin was a kind of gazette, that published the latest news of the empire.

Several of our modern coins have the legend round the edges: but the ancients were too wise to register their exploits on so nice a surface. As to the figures upon medals, the Romans always appear in the proper dress of their country, so that we may observe the little variations of the mode in the drapery of the medal: they would have thought it ridiculous to have drawn an emperor of Rome in a Grecian cloak or a Phrygian mitre. On the contrary, we often see a king of England or France dressed up like a Julius Cæsar, as if they had a mind to pass themselves upon posterity for  
Roman

Fig. 1

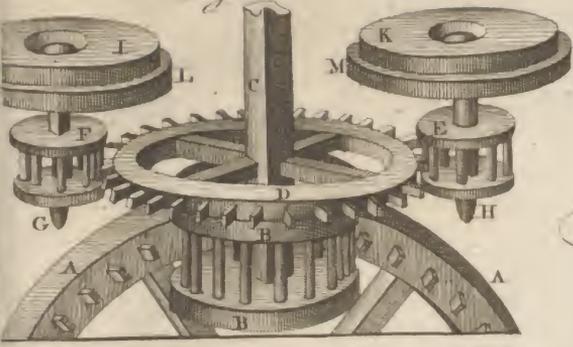


Fig. 3

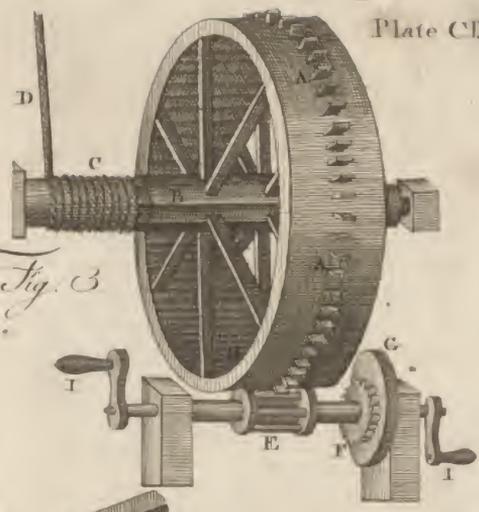


Fig. 2

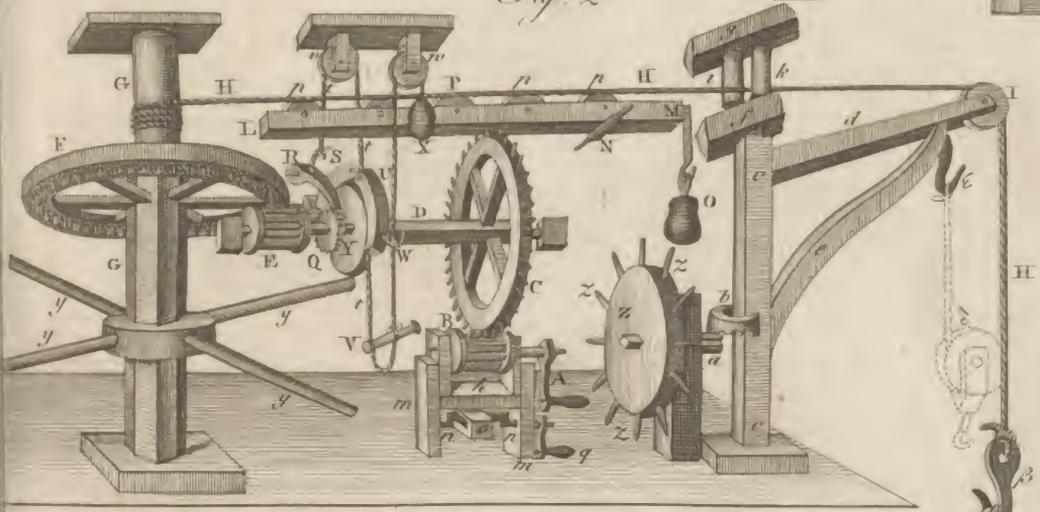


Fig. 4

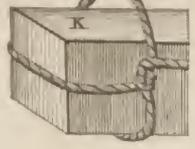
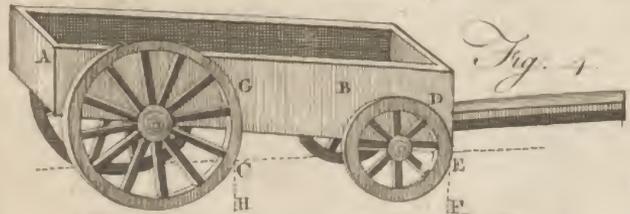


Fig. 5

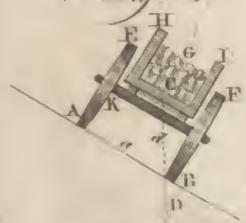


Fig. 6

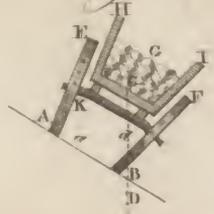
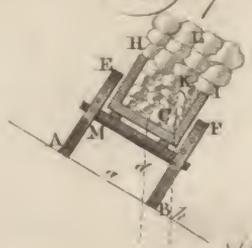
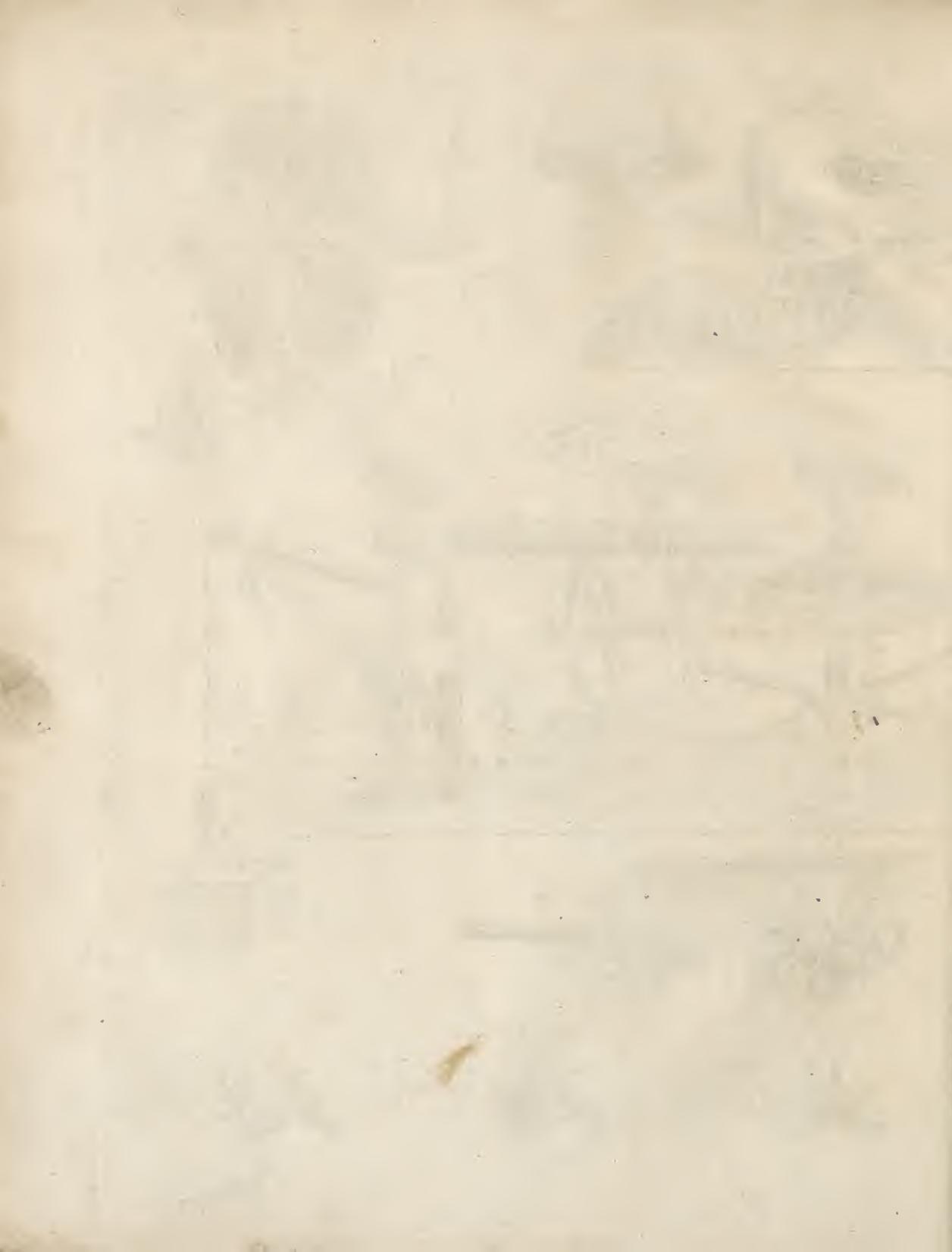


Fig. 7





Roman emperors. Nothing is more usual than to see allusions to Roman customs and ceremonies on the medals of our own nation; nay, they very often carry the figure of an heathen god. If posterity take its notions of us from our medals, they must fancy that one of our kings paid a great devotion to Minerva, another to Apollo, &c. or, at least, that our whole religion was a mixture of paganism and Christianity. Had the old Romans been guilty of the same extravagance, there would have been so great a confusion in their antiquities, that their coins would not have had half the use we now find in them.

The use of medals is very considerable: they give a very great light into history, in confirming such passages as are true in old authors, in reconciling such as are told in different manners, and in recording such as have been omitted. In this case a cabinet of medals is a body of history. It was, indeed, the best way in the world to perpetuate the memory of great actions, thus to coin out the life of an emperor, and to put every exploit into the mint. It was a kind of printing before this art was invented; and they have this advantage over books, that they tell their story quicker, and sum up a whole volume in twenty or thirty reverses: thus Mr Vaillant, out of a small collection of medals, has given us a chronicle of the kings of Syria. They are indeed the best epitomes in the world, and let us see, with one cast of the eye, the substance of above an hundred pages. Another use of medals is, that they not only shew the actions of an emperor, but at the same time mark out the year in which they were performed; for as every exploit has its date set to it, a series of an emperor's coins is his whole life digested into annals. A medallist, upon the first naming of an emperor, will immediately tell his age, family, and life. To remember where he enters in the succession, he only considers in what part of the cabinet he lies; and by running over in his thoughts such a particular drawer, will give an account of all the remarkable parts of his reign. Nor are medals of less use in architecture, painting, poetry, &c. A cabinet of medals is a collection of pictures in miniature, and by them the plans of many of the most considerable buildings of antiquity are preserved.

*Impressions of MEDALS.* A very easy and elegant way of taking the impressions of medals and coins, not generally known, is thus directed by Dr Shaw: Melt a little isinglass-glue made with brandy, and pour it thinly over the medals, so as to cover its whole surface: let it remain on for a day or two, till it is thoroughly dry and hardened; and then taking it off, it will be fine, clear, and hard, as a piece of Muscovy glass, and will have a very elegant impression of the coin.

Another easy method is as follows: Take a perfect and sharp impression, in the finest black sealing-wax, of the coin or medal you desire. Cut away the wax round the edges of the impression; then with a preparation of gum-water, of the colour you would have the picture, spread the paint upon the wax-impression with a small hair pencil, observing to work it into all

the sinking or hollow places, these being the rising parts of the medal; and the colour must be carefully taken from the other parts with a wet finger. Then take a piece of very thin post-paper, a little larger than the medal, and moisten it quite through. Place it on the wax impression; and on the back of the paper lay three or four pieces of thick woolen cloth or flannel, of about the same size. The impression, with its coverings, should be placed between two smooth iron plates, about two inches square, and one tenth of an inch thick. These must be carefully put into a small press, made of two plates of iron, about five inches and a half long, one inch and a half wide, and half an inch in thickness, having a couple of long male-screws running through them, with a turning female-screw on each, to force the plates together. These being brought evenly together, by means of the screws, will take off a true and fair picture of the medal; which, if any deficiencies should appear, may easily be repaired with a hair pencil, or pen, dipped in the colour made use of.

If a relievo only be desired, nothing is necessary, but to take a piece of card, or white paste-board, well soaked in water; then placing it on the wax-mould, without any colouring, and letting it remain in the press for a few minutes, a good figure will be obtained.

This method of taking off medals, &c. is convenient, and seems much more so than the several inventions usually practised in sulphur, plaster of Paris, paper, &c. wherein a mould must be formed, either of clay, horn, plaster, or other materials, which requires a good deal of time and trouble.

**MEDALLION, or MEDALION,** a medal of an extraordinary size, supposed to be anciently struck by the emperors for their friends, and for foreign princes and ambassadors; but that the smallness of their number might not endanger the loss of the devices they bore, the Romans generally took care to stamp the subject of them upon their ordinary coins.

Medallions, in respect of the other coins, were the same as modern medals in respect of modern money: they were exempted from all commerce, and had no other value but what was set upon them by the fancy of the owner. Medallions are so scarce that there cannot be any set made of them, even though the metals and sizes should be joined promiscuously.

**MEDELPADIA,** a small province of Sweden lying northward of Helsingia.

**MEDEOLA,** in botany, a genus of the hexandria trigynia class. It has no calyx; the corolla consists of six revolved segments; and the berry contains three seeds. There are two species, none of them natives of Britain.

**MEDIA,** in geography, the ancient name of Gilan. See **GILAN.**

**MEDIANA.** See **ANATOMY,** p. 241.

**MEDIASTINUM,** in anatomy. See **ANATOMY,** p. 278.

**MEDIATE, or INTERMEDIATE,** something that stands between and connects two or more terms, considered

as extremes; in which sense it is opposed to immediate.

**MEDICAGO**, in botany, a genus of the diadelphia decandria class. The pod is compressed; and the carina of the corolla declines from the vexillum. There

are nine species, four of them natives of Britain, *viz.* The falcata, or yellow medic; the sativa, or lucern; the lupulina, or melilot trefoil; and the arabica, or heart-trefoil.

## M E D I C I N E.

**MEDICINE** is generally defined to be, The art of preserving health when present, and of restoring it when lost.

Men would never think of any particular regimen or mode of living in order to preserve health, before they felt the pains which accompany the want it. The first painful sensation must necessarily have produced a desire for relief. But in a period when physicians and medicines were equally unknown, how was that relief to be obtained? or what system of conduct would man in this situation naturally follow? Whoever can answer these questions, will unfold the genuine principles of the medical art, and give an infallible standard for judging what progress has been made in the improvement of it, what particular circumstances have contributed to obstruct or forward the knowledge and cure of diseases.

Medicine being thus founded on a powerful instinct in human nature, its existence in some form must have been coeval with the first disease that appeared among mankind. Most arts require the experience of ages before they can arrive at a high degree of perfection. Medicine is unquestionably one of the most ancient; and consequently, the improvement of it might be expected to bear some proportion to its antiquity. But, whilst philosophy, in all its branches, has been cultivated and improved to a great extent; medicine, notwithstanding the collateral advantages it has of late derived from anatomy and other sciences, still continues to be buried in rubbish and obscurity.

Many causes have contributed to retard our progress in the knowledge of the causes and cure of diseases. In the early ages, prescriptions were either the result of tradition founded upon uncertain facts, or mere random trials without any rational view of success: Accordingly, when any uncommon case occurred, the patients were placed in cross-ways, and other public places, to receive the advice of passers who might chance to know the disease or an efficacious remedy. In this way valuable medicines might be accidentally discovered. But memory, and, in remarkable cures, engravings on pillars or the walls of temples, were poor instruments for recording the symptoms of diseases, and the ingredients of prescriptions.

After the knowledge of medicine began to be studied and practised as a liberal profession, a jealousy of reputation, joined to a thirst for money and ignorance of philosophy, laid a solid foundation for medical disputation. One party of physicians, known by the name of Empirics, excluded all reasoning, and trusted solely to experience. Another party, called Dogmatists, maintained, that no man ought to prescribe, without being able to give a

theory both of the disease and of the nature and action of the medicine. This dispute continued for ages, and, like other disputes of a similar nature, remains still in some measure undecided. The principles of both these parties are unquestionably good. But the physician who excludes either of them, will make but little progress in the knowledge of his profession. A judicious mixture of the two is indispensably necessary. Indeed it is difficult to determine whether too great an attachment to empiricism or dogmatism has contributed most to obstruct the improvement of physic.

But there is one cause which has operated more powerfully in preventing the improvement of medicine than even a combination of all the other causes. Most branches of philosophy are principally cultivated by people who expect their reward in reputation, not in money. The practice of physic is become as literally a trade as any branch of business whatever. Young men are taught physic with no other view than that of gaining their bread. Whenever a physician gets into extensive practice, he may bustle and make a noise; but, even supposing his abilities to be great, he can never find leisure to think, or digest his observations.

Another cause of the imperfect state of medicine arises from the varieties in constitutions, and the complex nature of diseases. It is even extremely difficult, after a disease has been cured, to determine with certainty, whether the cure was performed by the operation of nature, or by any particular virtue in the medicine. This difficulty is greatly increased by the variety of different medicines, and different ingredients in the same medicine, which are commonly administered during the course of a disease.

Of late several attempts have been made to reduce medicine into the form of a regular science, by distributing diseases into classes, orders, genera, and species. Sauvage was the first, and indeed the only person who ever attempted to complete this great work. Others, as Linnæus, Vogel, Dr Cullen, &c. have since endeavoured to improve Sauvage's method of classing; but they have contented themselves with an enumeration of the characters and arrangement of the different genera, without entering into their history or cure. Sauvage enumerates 315 genera, Linnæus 325, Vogel 560, and Dr Cullen has reduced them to 132. The bare inspection of these numbers shews, that physicians are far from being agreed with regard to what constitutes the generic or specific characters of a disease. Indeed we may venture to affirm, that they never will agree upon this point: The diagnostic symptoms of diseases are not so easily discovered as the stamina or petals in a flower, or the number of teeth or toes

in a quadruped. However, before making any observations on the advantages or disadvantages that may probably result from the classification of diseases, we shall lay before our readers the last and shortest distribution, published last year by Dr Cullen, one of the professors of medicine in the university of Edinburgh, under the title of *Synopsis Nosologiae Methodicae*, or rather, *Genera Morborum Præcipua*.

The doctor divides diseases into the four following classes, *viz.*

CLASS. I. PYREXIÆ, or Feverish Disorders.

II. NEUROSES, or Nervous Diseases.

III. CACHEXIÆ; comprehending such disorders as proceed from a diseased state of the whole or any part of the body, without an original fever, or any nervous complaint.

IV. LOCALES; comprehending diseases which affect a part only, not the whole body.

The first class (PYREXIÆ) is subdivided into five orders, *viz.*

ORDER I. FEBRES, or Fevers, is subdivided into two sections, *viz.* 1. Intermittent; and, 2. Continued fevers.—The first section contains three genera, *viz.*

1. The Tertian fever; 2. The Quartan; 3. The Quotidian:—The second section likewise contains three genera, *viz.* 1. The Synocha; 2. The Typhus; 3. The Synochus.

ORDER II. PHLEGMASIÆ, or fevers accompanied with any local pain. This order contains 17 genera, *viz.* 1. Phlegmone; 2. Ophthalmia; 3. Phrenitis; 4. Cynanche; 5. Peripneumonia; 6. Pleuritis; 7. Carditis; 8. Peritonitis; 9. Gastritis; 10. Enteritis; 11. Hepatitis; 12. Splenitis; 13. Nephritis; 14. Cystitis; 15. Hysteritis; 16. Rheumatismus; 17. Arthritis.

ORDER III. EXANTHEMETA, or eruptive fevers; comprehending 10 genera, *viz.* 1. Erysipelas; 2. Pestis; 3. Variola; 4. Varicella; 5. Rubcola; 6. Miliaria; 7. Scarlatina; 8. Urticaria; 9. Pemphigus; 10. Aphtha.

ORDER IV. HÆMORRHAGIÆ, or fevers accompanied with a flux of blood, not proceeding from any external cause. This order comprehends 4 genera, *viz.* Epistaxis; 2. Hæmoptysis; 3. Hæmorrhoids; 4. Menorrhagia.

ORDER V. PROFLUVIA, or fevers attended with an increased secretion, not naturally of the bloody kind. This order contains 2 genera, *viz.* 1. Catarrhus; 2. Dysenteria.

The second class (NEUROSES) is subdivided into four orders, *viz.*

ORDER I. COMATA, or lethargic diseases; containing 3 genera, *viz.* 1. Apoplexia; 2. Paralysis; 3. Catalepsis.

ORDER II. ADYNAMIÆ, or diseases arising from a stoppage or diminution in any of the involuntary motions, whether vital or natural. This order contains 4 genera, *viz.* 1. Syncope; 2. Dyspepsia; 3. Hypochondriasis; 4. Chlorosis.

ORDER III. SPASMI, or irregular motions of the muscular fibres. This order contains 13 genera, *viz.*

1. Tetanus; 2. Convulsio; 3. Epilepsia; 4. Palpitatio; 5. Asthma; 6. Pertussis; 7. Pyrosis; 8. Colica; 9. Cholera; 10. Diarrhœa; 11. Diabetes; 12. Hysteria; 13. Hydrophobia.

ORDER IV. VESANIÆ, or diseases of the mind, without a fever or coma. This order contains 4 genera, *viz.* 1. Amentia; 2. Melancholia; 3. Mania; 4. Somnium.

The third class (CACHEXIÆ, or diseases arising from a depraved state of the whole or a great part of the body, without a fever or nervous complaint,) is subdivided into 3 orders, *viz.*

ORDER I. MARCORES, or diseases attended with a wasting of the whole body; containing 2 genera, *viz.* 1. Tabes; 2. Atrophia.

ORDER II. INTUMESCENTIÆ, or diseases accompanied with an external swelling of the whole or a great part of the body. This order contains 13 genera, *viz.* 1. Polyfarcia; 2. Pneumatosis; 3. Tympanites; 4. Phymetra; 5. Anasarca; 6. Hydrocephalus; 7. Hydrorachitis; 8. Hydrothorax; 9. Ascites; 10. Hydrometra; 11. Hydrocele; 12. Phylconia; 13. Rachitis.

ORDER III. IMPETIGINES, or diseases attended with a cachexy which deforms the skin and external parts of the body. This order contains 8 genera, *viz.* 1. Scrophula; 2. Syphilis; 3. Scorbutus; 4. Elephantiasis; 5. Lepra; 6. Frambæsia; 7. Trichoma; 8. Icterus.

The fourth class (LOCALES, or diseases affecting only a part of the body,) is subdivided into seven orders, *viz.*

ORDER I. DYSÆSTHESIÆ, or diseases arising from any of the senses being destroyed or impaired by a fault in the external organs of sensation. There are 8 genera in this order, *viz.* 1. Caligo; 2. Amblyopia; 3. Dyscæcia; 4. Paracusis; 5. Anosmia; 6. Agheusia; 7. Anæsthesia; 8. Anaphrodisia.

ORDER II. DYSKINESIÆ, or diseases attended with the destruction or defect of motion in any part through a fault of the organs. This order contains 6 genera, *viz.* 1. Aponia; 2. Mutitas; 3. Paraphonia; 4. Pseudismus; 5. Strabismus; 6. Contractura.

ORDER III. APOCENOSES, or diseases attended with an increased flux of the blood or other humours, without a fever, or increased motion of the fluids. This order contains 5 genera, *viz.* 1. Profusio; 2. Epiphora; 3. Ptyalismus; 4. Enuresis; 5. Gonorrhœa.

ORDER IV. EPISCHESES, or diseases arising from a suppression or obstruction of any usual excretions. This order contains 3 genera, *viz.* 1. Obstipatio; 2. Ichuria; 3. Amenorrhœa.

ORDER V. TUMORES, or diseases attended with an increased size of the part, without a phlegmon. This order contains 14 genera, *viz.* 1. Aneurisma; 2. Varix; 3. Ecchymoma; 4. Schirrus; 5. Cancer; 6. Bubo; 7. Sarcoma; 8. Verruca; 9. Clavus; 10. Lupia; 11. Ganglion; 12. Hydatis; 13. Hydrarthrus; 14. Exostosis.

ORDER VI. ECTOPIÆ, comprehending diseases arising

sing from any part's being removed from its proper situation, and causing a tumor. This order contains 3. genera, *viz.* 1. Hernia; 2. Prolapsus; 3. Luxatio.

ORDER VII. DIALYSES; comprehending ulcers, and all kinds of wounds. This order contains 7 genera, *viz.* 1. Vulnus; 2. Ulcus; 3. Herpes; 4. Tinca; 5. Pfora; 6. Fractura; 7. Caries.

It is needless to enter into an examination of the propriety or impropriety of this or any of the other modes of distribution. Every one of them are defective in many particulars. Sauvage, Vogel, Linnæus, Dr Cullen, have each adopted peculiar theories of particular diseases. These theories constitute the basis of their different classifications. A person, therefore, who is not previously acquainted with these theories will naturally be surprised to find some diseases arranged under certain classes and orders. For example, who would expect to find a diarrhœa ranked under the class of Neuroses, and in the order of Spasmi, without knowing Dr Cullen's particular theory concerning the cause of that disease? The generic characters of many diseases will likewise be totally unintelligible to such a person.

However, notwithstanding these defects arising from the theoretical distribution of diseases, we cannot hesitate a moment in preferring even a bad method of classing to none at all. Every attempt towards a just and natural arrangement of diseases is laudable, and has a direct tendency to introduce science into the medical art; an object greatly to be wished for, but which still appears to be very distant. There is, however, a danger attending attempts of this kind which deserves to be pointed out. In every art which is not founded upon known facts and established principles, new projects are eagerly grasped at; and, though they lead to error and false reasoning, it is long before the professors of that art can be induced to give over the pursuit. This observation is peculiarly applicable to medicine. The theories of diseases, as well as the mode of prescription, are as variable as the fashions of a lady's head-dress. No other argument is necessary to shew the crude state of the art, and the boundless field for improvement. Now, the great danger arising from the classing of diseases is this:—It will divide physicians, in the first place, into two great parties: the one party will spend much time and genius in shewing the uselessness of classing in general, and particularly in the present imperfect state of the art; the other will imitate their example in defending with equal keenness. Nay, what is still worse, every professor belonging to this last party, besides spending much time to little purpose in justifying classification in general, will consume still more time in criticisms upon every other mode of classing besides the one he chuses to adopt. Now, this bustle about classification among the teachers of medicine, will naturally lead the minds of unexperienced students to conclude, that the whole science consists in a particular arrangement of diseases, and that they cannot make a more proper display of their medical knowledge, than by discovering an acquaintance with all the various methods of classification, and an acuteness in criticising all the other methods but that particular one which he has been taught to believe as infallible.

Having thus given a short account of the origin and present state of physic, we shall now proceed to the history and treatment of diseases.

#### *Of FEVERS in general.*

HOFFMAN defines a fever to be, "A spasmodic affection of the whole nervous and vascular system, annoying all the functions of the body, arising from any cause which has power to irritate the nervous parts to a more intense contraction; and when it operates, it drives the vital fluids from the outward parts to the heart and great vessels; and afterwards, when the systole of the heart and arteries are increased, they are drove back with rapidity and heat, through the constricted vessels, to the outward parts again, till the spasms being relaxed, the secretions are performed, and the fever vanishes."

The formal or fundamental cause of a fever consists in the spasmodic affection of the whole nervous and fibrous genus. This plainly appears from the usual phenomena of a fever, *viz.* a pain in the back, more particularly about the loins; a coldness, especially of the extreme parts; a shivering, shaking, trembling; a livid colour of the nails; a subsidence of the vessels of the hands and feet; a shrunk, dry skin; a yawning; a stretching; a pale, livid countenance; a trembling and palpitating motion of the heart; an anxiety of the præcordia, difficult breathing, inquietude, restlessness; a sensation of an ebullition of the blood about the heart; a contracted, weak, small pulse; a nausea, and an inclination to vomit; a suppression of perspiration; costiveness, with thin watery urine.

Hence it naturally follows, that whatever has a power to irritate and solicit the nervous and vascular system to spasms, is most likely to generate a fever. To this class belong violent passions of the mind, especially terror and anger; a poisonous, subtle, caustic matter, either bred within the body, or received by infection; a stoppage of perspiration; a suppression of critical sweats; eruptions driven back; an abundance of purulent ulcerous matter adhering to various parts; aliments too acrid and sharp; corrupt and bilious crudities lodged in the primæ viæ; excessive watching; a violent pain and tension of the nervous parts; inflammations, tumours, and abscesses; hurting the nervous parts by sharp instruments; acrid and corrosive drugs; cold baths, and, on the contrary, those that are too hot or astringent.

According to the different nature of these causes, and the various manner of affecting the nerves, arise fevers of divers kinds. Some are benign, others malignant; some are intermitting, others continual; some are simple, others compound; others regular or anomalous; eruptive, spotted, putrid, hectic, or slow. Some admit of an easy cure, others a difficult; some soon terminate, others are protracted a long time; and many hurry the patient suddenly out of the world.

Yet, every frequent systole of the heart and arteries discoverable by the pulse ought not to be called a fever. For these may often arise from violent bodily exercise; or, from a commotion in the blood caused by hot and spirituous liquors. That only which arises from internal causes, and is preceded by shivering, shaking, and cold-

ness

ness of the extreme parts, is properly a fever: For there is always, as it were, a double motion in a fever; the one from the circumference to the centre, or from the external parts to the internal, the heart and lungs; the other from the centre to the circumference. The first motion is attended with a small, contracted, weak, pulse, with an anxiety of the præcordia and difficulty of breathing; the second with an increased motion of the arteries, a large pulse, and heat extended even to the extreme parts.

The cause of the febrile motion is an universal spasm; and that motion never ceases till the spasm is resolved. The signs of its being resolved are, a free perspiration, and a breathing sweat; the pulse, which before was hard, impetuous, and quick, becomes soft, moderate, and slow; the urine lets fall a sediment, and the strength gradually returns. When these appear all together, they declare the solution of the disease, and are called the crisis.

#### Of INTERMITTING FEVERS, or AGUES.

THIS fever is of the regular kind, and is attended with the following symptoms. At first, the head aches, the limbs seem weary; there is a pain in the loins about the first vertebra of the back, which ascends towards the epigastrium, with a painful sense of a tension in the hypochondria, and costiveness: then comes on a coldness of the external parts, especially of the nose and ears; a stretching, yawning; a shivering and shaking, sometimes even to make the bed tremble under the patient; the pulse is small, contracted, and weak: again the patient is troubled with thirst; then follows a nausea, with a fruitless reaching to vomit; again, a pituitous, bilious, or green matter is brought up, commonly joined with a troublesome cough, and an expectoration of phlegm derived from the acid clammy crudities of the stomach; to these succeeds an anxious burning and dry heat, which pervades the whole body. The face, which was collapsed and pale, the contracted, rigid skin, and the empty vessels of the hands and feet, begin to rise, and grow red and turgid; the pulse becomes more great, full, and quick; the restlessness increases, the breathing is more difficult, and the patient, with his eyes almost closed, begins to talk a little wildly.

Afterwards, the symptoms begin to abate, the heat becomes mild, the skin relaxes and grows moist; the urine is of a flame colour, but without a sediment; the pulse is more moderate; and then a sweat breaking out, terminates the paroxysm. The duration of the fit is uncertain; sometimes it ends in ten or eleven hours, and sometimes not till twenty-four. On the intercalary day, the body is still feeble and coldish, with a disposition to shiver; the pulse is slow and weak; the urine is turbid, and deposits a sediment, or there is a nubecula which shews a disposition thereto.

In the *BASTARD* or *SPURIOUS TERTIAN*, the symptoms are milder, the heat is not so burning, the vomiting is not so frequent, and the urine is not so high-coloured; but then it is a more lingering complaint, and on the well day there is a lassitude and want of appetite. This attacks men of an inactive disposition, and women whose bodies are of a loose texture, in the autumnal season.

The fit of the *IRREGULAR TERTIAN* observes no

particular time; for it sometimes comes on in the morning, sometimes in the afternoon, in the evening, or at midnight. The paroxysm is sometimes longer, sometimes shorter; the urine lets fall no sediment within the time of remission or intermission; the sweating is either too sparing or too profuse. When the fit is off, several unusual symptoms may appear; as, a looseness, a bleeding at the nose, sickness at the stomach, a violent heartburn, pains in the belly, or the gripes. These sort of agues are generally *EPIDEMIC*, and most commonly appear in the summer and autumn.

Sometimes a tertian ague is *DOUBLE*, which may be distinguished from a quotidian, by the time of the fits, which is not the same every day, but every other day.

There is sometimes a *CONTINUAL TERTIAN*, which begins with shivering and shaking, an anxiety, vomiting, loss of strength, and then a violent heat. The fits do not intermit, but only remit. The pulse continues frequent with heat and debility, and all the symptoms return with fresh vigour every other day; but at length admit a perfect intermission.

An *ENDEMIC TERTIAN* is proper to certain places; as a low situation, and full of marshes, producing a great number of gnats and other insects, like some parts of Kent, and the hundreds of Essex. In such places, the natives themselves have a little of it every year; and strangers seldom or never escape, without a preservative, which is only the bark infused in brandy, with a little snake root, of which two ounces night and morning are to be taken.

A *QUARTAN AGUE* has two fits in four days, or two days quite free from a fit.

It begins about four or five in the afternoon, sometimes sooner and sometimes later, with a great lassitude, stretching, a blunt pain in the head, back, loins and legs; the feet and hands are cold; the whole body is pale; the face and nails livid, to which shivering and shaking supervene. The tongue and the lips tremble, the breathing is difficult, with restlessness and tossing; the pulse is contracted and hard, and sometimes unequal; and there is an anxiety about the præcordia. These symptoms continue about two or three hours. In some the body is costive; in others there is a stimulus to stool, and to make water. In some there is a nausea or vomiting, with stools. Some advanced in years have their minds pretty much disturbed; the heat comes on gradually, not burning but dry; the pulse becomes equal, quick, and large; but the dull pain in the head remains, with a vertiginous affection; the skin becomes only a little moist; and in about four or six hours the symptoms vanish, except a dull pain in the bones, joints and feet. The urine in the fit is sometimes thin and watery, sometimes thick and with a sediment.

Sometimes a quartan ague is *DOUBLE*, that is, when the fits come on every other day at different hours; and it is *SPURIOUS* when a paroxysm begins at any other time of the day but that above-mentioned. It is said to be *CONTINUAL*, when on the intercalary days there are shiverings and pandiculations, with a greater heat than usual, a quicker pulse, a want of appetite, a debility, a dryness of the mouth, a lightness of the head, a disturb-

ed sleep, and a reddish urine, with a thick rose-coloured sediment.

A QUOTIDIAN AGUE or fever returns every day, and is not so common as the tertian or quartan.

The accession of this fever is about four or five in the morning, with cold and shivering; to which succeeds a cardialgic nausea, and inflation of the belly; in some, a pain in the head; in others, fainting fits; in most, vomiting or stools, or both. Then comes on a moderate heat, with thirst, but not very intense. The pulse, which was before irregular and weak, becomes more quick, but not very hard. The urine is not of a flame but rather of a citron colour, and turbid. Some are exceeding sleepy. At length a moderate sleep supervenes; and in about ten hours or longer, the fit goes off, leaving the body dull and heavy.

From these symptoms it appears, that the whole nervous system is agitated and suffers greatly by spastic contractions; which proceeding chiefly from the medulla spinalis, affect preternaturally not only the coats of the vessels, but all the fibres throughout the body, thereby greatly disturbing the motion both of the solids and fluids.

The material cause of this, and all other fevers, according to Hoffman, is a fluid of an active nature, endued with a caustic acrimony, which solicits the internal and exquisitely sensible parts to spastic contractions. It is generated chiefly in the biliary ducts and flexures of the duodenum; where the vitiated, bilious salival and pancreatic juices meeting with the crudities of a bad digestion, ferment together, and, not being timely expelled, become virulent. This matter passing through the lacteals, into the blood, and thence into the nervous parts of the head, medulla spinalis, intestines, and stomach, as also to the nervous coats of the excretory and secretory ducts, excite an universal spasm, which first forces the blood to the interior and greater vessels; and afterwards the systolic motion of the heart and arteries being increased, the motion of the whole mass of blood and humours is accelerated, and the obstructions of the small vessels of the nervous parts are opened; upon which the spasm ceasing, the excretory ducts are relaxed, the febrile matter passes off through the pores of the skin by perspiration or sweat, and the fit ceases, till by the generation of fresh matter a new paroxysm is brought on.

As to the cure, when a load of vitiated humours in the stomach and duodenum require depletion, which is known from having indulged in too plentiful eating, from an anxiety of the præcordia, from eructations, and a bitter taste in the mouth, a vomit, after the first fit, in the time of intermission, is to be given. In tender constitutions, 10 grains of ipecacuanha may be given alone; but to the more robust, a grain or two of emetic tartar may be added. Or if it is necessary to purge at the same time,

1. Take half an ounce of Epsom salt, and two or three grains of emetic tartar. Mix them and make them into a powder; to be dissolved in a pound of pure lukewarm water, and taken two hours after the fit.

The evacuation ought to be facilitated with draughts of water-gruel made fat with fresh butter. Then take the

following electuary, which will crush the disease in the bud.

2. Rob of elder, one ounce; 5 drams of Peruvian bark; 2 drams of chamomile flowers in powder; extract of the lesser centaury, and powder of jelliflowers, of each half a dram; add as much syrup of lemon as will make an electuary. Half a dram to be taken every two hours, after the fit has gone off.

But if any thing forbids vomiting, and yet there is plenty of ferous crude humours which require evacuation, we must begin the cure with detergent and aperient salts.

When the whole intestinal canal has been cleansed by these salts, duly repeated at proper intervals, and the ague still continues, add an equal weight of bark thereto, or give the electuary above prescribed.

When the patient is obnoxious to the hypochondriac passion, the stomach inflated, and the body coltive, neither vomits nor salts must be ventured upon, but carminative and emollient clysters.

But it must be remembered, that neither bleeding, nor emetics, nor cathartics, nor the bark, nor any strengthener nor astringent is to be administered or given in the fit, or near the time it usually comes on.

If a tertian is autumnal, obstinate, or changes to a quotidian, the antifebrile potion of Crollius will be proper.

3. Salt of wormwood, a dram; spirit of sulphur, a scruple; 4 ounces of fennel water. Mix them together for a drink.

Let the patient take it just as the fit comes on, and be well covered with bed-cloaths.

Bleeding is proper only in a hot season, when the heat of the patient is excessive, attended with a delirium, and in the prime of life, full of blood, and subject to passion.

Opiates will appease the symptoms; but they disturb the crisis, and protract the disease. Likewise aluminous, chalybeate, and vitriolic remedies will stop the fits; and if they are given to patients of the lowest class, care must be taken that they sweat after them, by drinking hot decoctions, or by exercise.

Absorbents have often a happy effect in these diseases; but if given in too great a quantity, they will not dissolve in the stomach. Harris advises 2 scruples of the simple powder of crabs claws, two hours before the fit, and to be repeated in an hour, in mint-water; no small beer is to be drank for eight hours after. It may be repeated in the same manner against the next time the fit is expected; as likewise a third time.

Langrish asserts, that in long continued agues or intermitting fevers, which have baffled the bark and many other medicines, he has met with more advantage from rhubarb and calomel exhibited in small doses, than from any thing else he had tried.

To prevent the return of an ague, the bark must be repeated every week or ten days, for three several times, with the same intervals. Likewise bitters and chalybeates are very serviceable for the same purpose.

*Of the CATARRHAL FEVER, or the Continual Quotidian of the ancients.*

It generally begins in the evening, with a shivering and

and a coldness of the extreme parts, especially of the feet, and soles of the feet; a costiveness; a frequent desire of making water, but the urine is small in quantity; a weakness of the head, an universal languor of the whole body, a false appetite, thirst, difficulty of swallowing, a stimulus in the larynx; a heat in the nostrils and fauces, attended with sneezing; a weight in the breast: towards night, heat, and a quicker, fuller pulse, with a defluxion of rheum, a heat in the fauces, unquiet sleep, a sweating in the morning, a heaviness and dulness of the whole body, and a loss of appetite.

The immediate cause of this disorder is a sharp acrid serum or lymph, subsisting in the glandulous tunics, and irritating them with pain, tumour, and redness. This happens in the whole region of the nostrils, palate, and fauces; as also in the aspera arteria, with the bronchial branches; and farther in the oesophagus, stomach, and intestines. Hence a hoarseness, a cough, a hawking up of viscid matter, a sneezing, a defluxion of the lungs: likewise a nausea, sometimes a vomiting; a heat about the præcordia; a griping of the guts, followed with a salutary flux.

It more frequently attacks women and children than men, and those that indulge themselves in strong liquors. It sometimes happens from the drying up of a scald head and other eruptions. Sometimes it is epidemical.

This disease is most frequent in the spring and autumn, in sudden changes of the weather from hot to cold, from dry to moist, and *vice versa*; as also from change of air, if of different qualities; from being exposed to the cold air of the night, and from throwing off winter-garments too soon.

This disease is not dangerous in itself, if rightly managed, and terminates in seven or fourteen days at farthest: for the lassitude of the body then disappears; and the other complaints, especially the head-ach and hemicrania are appeased, when the catarrh appears, and there is a plentiful discharge from the nostrils.

It often goes off, in some, in the beginning, with an increased perspiration or by sweat; in others after a few days, by hawking up a large quantity of viscid matter, or a plentiful discharge of a mucous serum by the nose; in others, by a looseness, when the urine at the same time, which before was thin and little, becomes copious and heavy, with twice the quantity of sediment as in a natural state.

The intentions of cure are three, 1. To stanch the acrimony of the lymph. 2. To increase perspiration. 3. To promote the expectoration of the viscid mucus.

The saline sharpness of the lymph may be taken off by the absorbent and diaphoretic powders, humecting and oleous remedies; such as, oil of sweet almonds, spermaceti, milk, cream, almond emulsions, with the addition of white poppy seeds, barley-broth, water-gruel, chicken broth, with the yolk of an egg; as also liquorice-juice, liquorice-tea, dried figs and raisins. If the acrimony is very subtle and corroding, gentle anodynes should take place, such as saffron, diacodium, and stozax pills.

To promote a diaphoresis,

1. Take a scruple of the powder of *contrayerva*; Vir-

ginian snake-root and saffron, of each 5 grains. Mix and make them into a powder. To be repeated in 4 or 6 hours, if necessary.

To appease the cough,

2. Take oil of olives, an ounce and a half; pure water, 6 ounces; spirit of hartshorn, 40 drops; pectoral syrup, one ounce. Mix them, and take a spoonful every four hours.

To promote perspiration, order tea, with leaves of veronica, hyssop, liquorice-root, elder flowers, wild poppies, and fennel seeds; as also the more fixed diaphoretic powders, with antispasmodic waters; but especially bodily motion and exercise.

To promote the excretion of the thick, viscid mucus, figs and raisins are proper, with brandy burnt, and reduced almost into a syrup. Likewise a pectoral elixir, made of gum ammoniac, myrrh, liquorice-root, elearcampen-root, saffron, benjamin, and oil of anniseed, whose virtue may be heightened by the vinous spirit of sal ammoniac or tincture of tartar. The stagnating mucus of the nose may be dissolved by often holding to the nose the dry volatile sal ammoniac, mixed with a few drops of genuine oil of marjoram.

The regimen should be temperate; and cooling things, as well as acids, should be avoided.

The aliment should be sparing, the drink warm and wholesome; the best is a decoction of pearl-barley and shavings of hartshorn, as also water-gruel.

If the body is costive; besides water-gruel, manna, prunes, and raisins, nothing is better than an emollient clyster.

In the decline of the disease, when the cough is too moist, the defluxion great and obstinate, it will be proper to take a large dose of manna, to two or three ounces in fennel-water, to carry the humours downward.

When the cough is very violent, it must be appeased with a mixture of oil of sweet almonds fresh drawn, and French syrup of capillaire.

When women labour under a suppression of the menses, the body must be kept open with clysters; bezoardic powders must be given, and a grain of saffron added to each dose, or a few grains of flowers of sulphur; but avoid sweet things and expectorants.

When the fever is vanquished, and the lungs continue in a lax state, which is known from too large a spitting, to the bezoardic powders must be added a few grains of cortex cleuthericæ.

In a violent obstinate cough, sweet pectorals, and in-craffating remedies too plentifully given, bring on a cachexy, or phthisis, by spoiling the appetite, and hurting the tone of the lungs. HOFFMAN.

What we commonly call CATCHING COLD, may be cured by lying much in bed; by drinking plentifully of warm sack-whey, with a few drops of spirit of hartshorn, posset-drink, water-gruel, or any other warm small liquor; lying upon spoon-meats, pudding, and chicken, and drinking every thing warm: In a word, treat it at first as a small fever, with gentle diaphoretics; and afterwards, if any cough or spitting should remain, by softening the breast with a little sugar-candy and oil of sweet almonds, or a solution of gum ammoniac in an ounce of barley-

barley-water to make the expectoration easy, and afterwards going into the air well clothed.

*Of the SEMITERTIAN FEVER.*

THIS is an epidemic fever, compounded of an intermitting tertian and a continual quotidian.

It generally makes its onset before noon, with coldness, shaking, and a contracted pulse; to which succeeds a frequent pulse, with heat, which continues some hours, till a warm sweat appears, without a complete intermission. The heat, after a slight chillness, increases towards night, with a quick pulse; which is more moderate the next day, without thirst, till the evening, when a slight shivering comes on, and the symptoms return. On the third day, the shaking fit appears again with more intense heat, and proceeds in the same track as before; so that the fever is never quite off, but has an exacerbation in the evening: however, the shaking fit is most conspicuous every third day in the morning.

Besides the foregoing symptoms, the strength fails, the appetite is languid, sleep is wanting, the urine is thin and crude; but after the fit on the third day, it is thick and coloured, and a small quantity of crude matter is brought up with coughing. It is sometimes attended with a pain in the back and the abdomen, together with a swelling in the latter. Some at the access of the fit of the tertian, are affected with a nausea and cardialgia. Some vomit, others faint, and others again are delirious.

This fever is generated by all things that render the humours thick and impure, especially those that fill the primæ viæ, and the vessels of the mesentery, with impurities. Those are most liable to it who live upon sweet, acid, and fermentable aliment, that live an idle sedentary life, that drink less than they ought, or love sweet wines; as also those that give way to sadness and melancholy.

It generally terminates either on the ninth or thirteenth day, in health, or another disease, or death.

It is a good sign when a sweat breaks out at the decline of the paroxysm, and when, on the seventh day, being critical, or, after it, the belly is disturbed, and is followed with a flux of a bilious, pituitous, or bloody matter, for it foretells the solution of the disease; as also when the pains in the belly are very sharp, and grow worse at certain hours, being followed with a sanious and purulent diarrhœa, or when plenty of black blood comes away.

It is a bad sign, when nothing of this happens: but, on the other hand, a heat about the præcordia, a tension and pain in the whole region of the stomach, a vomiting and hiccup, inquietude, tossing and trembling of the hands, are very ominous, and shew that the inflammation has reached the stomach.

The cure is to be performed, 1. By speedily discussing the inflammatory stasis in the coats of the intestines and mesentery, and preventing it from spreading farther. 2. By correcting and gently evacuating the matter of the intermitting fever.

The first end may be obtained by diaphoretic powders, mixt with a little nitre, in small doses, but taken often.

Take of scorzonera root, 2 ounces; shavings of

hartshorn, and passular, minor, of each one ounce; of chicory root, half an ounce. Boil the ingredients for half an hour in 8 pounds of water.

To cleanse the first passages, and to carry off the morbid matter, use a solution of manna with cream of tartar, raisins, and a little sal polychrest.

Things of this kind cleanse the intestinal canal, without raising a commotion in the blood, without stimulating the nervous parts, and without sinking the spirits.

Purges in the beginning are unsafe, because the morbid matter is not prepared; but if the body is costive, it may be opened with an emollient and saponaceous clyster.

All detergent salts are improper in this disease, except stibiated nitre and sal polychrest; for these have an aperient, diuretic and laxative virtue, and may be given to 15 grains in a proper vehicle. When this fever is on the decline, and nature seems intent in carrying off the disease by stool, then the above laxative will be proper.

Bleeding will be proper in the very beginning of the disease, if the patient is plethoric, the heat urgent, the strength not much impaired, and when some critical hæmorrhage is suppressed. All heating medicines are to be avoided, as well as fixt astringent earthy testaceous powders; and also the bark, unless there is a perfect intermission; for this last, as Baglivi observes, has brought on fatal inflammations, or slow hectic fevers.

*Of the NERVOUS FEVER.*

IN a nervous fever, the patients at first are subject to slight transient chillnesses often in a day, with uncertain flushings of heat; they have a listlessness, lassitude, and weariness; they are apt to sigh, and complain of a heaviness, dejection, and anxiety, with a load, pain, or giddiness of the head, with an inclination to yawn and doze; they want appetite, and dislike every thing; they have a dryness of the lips and tongue without any considerable thirst; they have frequent nausea's, with reaching to vomit: the breathing is difficult by intervals, and especially towards night there is an exacerbation of the symptoms, with a low, quick, unequal pulse; the urine is pale, and made often and suddenly; a torpor, or obtuse pain and coldness often affect the hind-part of the head, or a heavy pain is felt along the coronary suture. These commonly precede some degree of a delirium.

The countenance is heavy, pale, and dejected: sometimes they are quite wakeful; and when they fall asleep, they are so insensible of it, that they disown it.

The pulse is very remarkable in this disease, and requires the most diligent attention; for it is generally low, quick, and unequal: the inequality consists in this, that a few pulsations shall be more swift, frequent, and large, sometimes fluttering; and then presently it returns to be low and quick.

The urine has generally no sediment; and when it has, it is like bran; it is sometimes of a whey-colour, or like dead small-beer. The dryness of the tongue seldom appears at the beginning, though it is then sometimes covered with a thin whitish mucus; but at the close of the disease, it often appears very dry, red, and chapped.

About the seventh or eighth day the giddiness, pain, or heaviness of the head, become much greater, with a constant

stant noise in it, or tingling of the ears, which is frequently the forerunner of a delirium.

The load on the præcordia, the anxiety and faintness, grow much more urgent; and the patient often falls into an actual deliquium, especially if he attempts to sit up. Now, cold sweats appear suddenly on the forehead and back of the hands, while the cheeks and palms glow with heat, and as suddenly go off. If the urine grows more pale and limpid, a delirium is certainly at hand, with universal tremors and *subfultus tendinum*; the delirium is generally little more than a confusion of thought and action, a continual muttering and faltering of speech. Sometimes they awake in a hurry and confusion, and presently recollect themselves, but forthwith fall into a muttering, then doze again.

At the state, the tongue grows often dry, with a yellow list on each side; and when the patient attempts to put it out, it trembles greatly. If at this time a copious spitting comes on, it is a very good sign. When there is a difficulty of swallowing or continual gulping, it is a dangerous symptom, especially with a hiccup.

On the ninth, tenth, or twelfth day, the patient often falls into profuse sweats, which at the extremities are commonly cold and clammy; and frequently there are thin stools, which are generally both colliquative and very weakening. A warm moisture on the skin is reckoned salutary; and a gentle diarrhoea often carries off the delirium and sleepiness.

When the extremities grow cold, the nails livid, the pulse exceeding weak and quick, inasmuch that it rather trembles and flutters than beats, or creeps surprisingly slow, with frequent intermissions; then nature sinks apace, and the patient becomes quite insensible and stupid; the delirium turns to a profound coma, which soon ends in death; or the stools, urine, and tears, run off involuntarily, as a prelude to a speedy dissolution; or there are vast tremblings and twitchings of the nerves and tendons, which terminate in a general convulsion, and this in a cessation of all motion. One or other of these ways closes the scene, after the patient has languished fourteen, eighteen, or twenty days, nay, sometimes much longer.

All persons grow deaf and stupid towards the end of the disease, and if the deafness ends in an imposthume of the ear, or when a *parotis* suppurates, or a large pustular eruption breaks out about the lips and nose, they are good symptoms.

The cure is to be performed with gentle medicines of the cordial and diaphoretic kind, in order to promote perspiration; by application of blisters, and by a proper regimen and method of diet. It will bear no other evacuation than moderate cordial diaphoretics, and blisters; unless a gentle emetic should be indicated in the beginning, or a small dose of rhubarb when it has continued long. Bleeding is very prejudicial, and much sweating hurtful. In giving diaphoretics, we should always have regard to the urine; for if that, from being pale, gradually heightens to an amber colour, we are right in our dose, especially if, when in bed, a gentle dew or moisture comes on without a restlessness; and we must always remember, that over-sweating will raise the fever, and endanger the patient.

If the patient is inclinable to deliquia or faintings on

every little motion, or complains of greater lassitude or faintness than ordinary, it will be necessary that he lie in bed and have blisters applied; if delirious, the blisters must be laid on high on the nape of the neck.

If rest is wanted, give a few grains of the *flores martiales*; and if a looseness is not feared, the *flores martiales* may be more freely given.

A vomit ruffles nature much less than a common purge, and is necessary where a nausea, load, and sickness of the stomach, are urgent. If the body is costive, clysters of milk, sugar, and salt, may be injected with safety and advantage every second or third day. The temperate cordial and diaphoretic medicines are certainly most proper in these fevers; a supporting, well regulated, diluting diet is necessary, and will go a great way in the cure, especially if assisted by well timed blisters, and keeping the patient quiet in body and mind. Opiates are commonly very pernicious; mild diaphoretics, as *pulv. contrayerv.* compos. with a little castor and saffron, and small quantities of *theriac. androm.* or *elixir paregericum*, will have much better effects. Where the confusion or dejection of spirits are considerable, galbanum or sulphium, with a little camphire, should be added; and blisters should be forthwith applied to the neck, occiput, and behind the ears: during all this, a free use of thin wine-whey, some pleasant ptisan, with a little soft wine, must be indulged. A little chicken-broth also is of service, both as food and physic, especially towards the decline of the disorder; and for the same reason, thin jellies of hartshorn, sago, and panada, are useful, adding a little wine to them, with juice of Seville oranges or lemons.

It was said above, that profuse sweats should never be encouraged; yet the patient is never so easy as while he is in a gentle, easy sweat, for it soon removes the exacerbation of the heat, hurry, &c. when there are irregular partial heats, with great anxiety, restlessness, delirium, difficulty of breathing, and a vast load and oppression on the præcordia, so as to resemble a peripneumonic case: yet beware of bleeding; for the small, low, quick, and unequal pulse utterly forbids it, as well as pale, watery, limpid urine.

Here then the nervous cordial medicines are indicated, and blisters to the thighs, legs, and arms.

Take of the compound powder of contrayerva, 15 grains; of English saffron, 3 grains; a scruple of the cardiac confection; and a sufficient quantity of syrup of saffron to make a bolus.

When great tremors and *subfultus tendinum* come on, instead of the *pulvis contrayerva*, a scruple of mull may be used.

This bolus should be taken every fifth, sixth, or eighth hour, and a temperate cordial julep may be given now and then out of thin wine or cyder-whey, or, which in many cases is better, out of thin mustard-whey.

But this difficulty of breathing, anxiety, and oppression of the præcordia, often precede a military eruption on the seventh, ninth, or eleventh day, which should be promoted by soft, easy cordials, proper diluents, sometimes with a little *theriaca androm.* or *elixir asthma.* as tending to calm the uneasiness, and to promote a diaphoresis.

In profuse, colliquative sweats, give a little generous

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red wine, perhaps a little diluted, which moderates the sweat, supports the patient, and keeps up the miliary papillæ.

Towards the decline of the fever, when the sweets are copious and weakening, give small doses of the tincture of the bark, with saffron and snake-root, interposing now and then a dose of rhubarb, to carry off the putrid colliculies, which makes the intermissions or remissions more distinct and manifest.

When there is an evident intermission, give preparations of the bark out of draughts made with salt of wormwood and juice of lemon. This method will shorten these fevers, even with miliary eruptions.

Under any evacuations, diluting nourishment is absolutely necessary to keep up the spirits and repair the loss of the juices, and the patient should be frequently prompted to take them. When any discharges are very immoderate, they may be prudently restrained, but not repelled.

Gilchrist affirms, that to all the warming, attenuating, stimulating, or antispasmodic remedies, cinnabar should be added, and that in no small quantity. And he highly recommends the use of the bark in the decline of long nervous fevers, or after a remission. And when there is occasion for blistering, he thinks the head most preferable whenever it is much affected, though he does not disapprove the laying blisters on the back and limbs.

When the low, depressing, nervous symptoms are stronger, the higher methods of stimulating are more necessary and easily borne; in raving, with a low, intermitting pulse, subsultus, fainting, and coldness of the extremities, besides frequent blistering, we must give camphire and castor. The uses of Virginian snake-root, valerian, asa fetida, myrrh, and terreous absorbents, are well enough known, and the forms in which they are given. Refreshing juleps should not be taken by spoonfuls, but by draughts. Acrid cataplasms may be laid to the feet till they begin to stimulate or raise a just degree of heat: then apply poultices of bread, milk, and vinegar, especially during the exacerbation, to allay the heat and struggle; renewing them alternately, in order to keep up a gentle heat and stimulus. A quick, hard, and more contracted pulse, with smart heat, tossing and anxiety, shew it is over-done.

#### Of Epidemic, Catarrhal, Eruptive FEVERS.

THESE fevers are continual, but not violent: they are attended with a prostration of strength, watching, loss of appetite, and are sometimes joined with an eruption of spots on the skin, arising from the plenty and intestine dissolution of an excrementitious serum, not without contagion and danger of life.

These fevers were called by the ancients, *continual, quotidian, serous fevers*; and by some of the moderns, *malignant catarrhal fevers*, because they are mild at first, and attended with a running at the nose, a catarrh, an inflammation of the breast, and a cough on the first days, with exacerbations at night.

At the beginning of this disease, the face of the patient has a morbid aspect, and he is out of order three or four days before he takes to his bed. He complains of a spon-

taneous weariness, a grievous pain of his body and joints, as if his bones were bruised and broken; his strength is languid, his appetite is lost, he has a slight fainting fit, a cardialgic nausea, a pain in the head, an unquiet sleep, with costiveness. In the evening there is a coldness and shivering followed by heat, the symptoms increase, and there is a greater loss of strength, inasmuch that he can scarce stand upright. The pain in the head grows worse, with a giddiness and inquietude. Some have a violent pain in the back, others in the side: they have an anxiety about the præcordia, the internal parts are hot, the fauces dry, the pulse contracted, quick and weak, the urine is pale without a sediment, and the breathing difficult.

On the fourth or eleventh day, spots appear in some, chiefly on the back, breast, and arms, with or without relief. Some have more, some less, of various colours, as purple, a brownish, livid, or a pale rose. These are sometimes broad, sometimes small; and in many like flea-bites. These different spots serve to distinguish the fever by several names, such as miliary, puncticular, bastard petechial, and the like.

When this disease is at its state, or vigor, all the symptoms are worse; the inquietude runs very high, as well as the tossing of the body with unusual postures. The mind is disturbed, the speech incoherent, sleep wanting, the sweat is coldish, with a more intense difficulty of breathing, and a contracted, unequal, quick and frequent pulse, as in the nervous fever.

When a subsultus tendinum, want of thirst, rumbling in the belly, hiccup, an inflammation of the fauces from aphthæ, convulsions, a syncope, with coldness of the extremities, and a most plentiful sweat, supervene to these symptoms, they are certain forerunners of death. On the other hand, when a sweat breaks out about or on the critical days, that is, the seventh, eleventh, or fourteenth day, and continues several days, though want of strength remains; or if there is a looseness for some days, it is a sign of health: and this the more certain, if the contracted pulse enlarges, the hard grows soft and becomes more equal; if the patient is more chearful, and his lying in bed more sedate, with a hardness of hearing, and a turbid urine depositing a sediment. If this happens about the critical days, it is a certain sign of a happy event. After this the sleep, appetite, and strength, gradually return; but this is seldom the case before the fourteenth day.

Patients of a strong constitution, the common people, and rustics, with a good regimen alone, generally succeed better than the weak, the timorous, the sad, the thoughtful, the luxurious, the slothful, and the studious. All excretions by urine, stool, or sweat, are bad in the beginning, and on other days except the critical. Those that die are carried off by a palsy, or an inflammation of the meninges, or of the œsophagus and fauces from aphthæ of the stomach itself. If blood is taken away in these diseases, it is either of a bright red, very fluid and serous, or too thick and blackish.

In the cure of this disease, the physician should take care not to disturb the salutary excretions, but proceed cautiously, and abstain from strong medicines of every kind, watching and assisting the motions of nature as much as possible. The indications are, 1. To restrain and pre-

vent the entire dissolution of the blood and humours. 2. To temperate and dilute the salino-fulphureous acrimony of the humours, and at the same time to keep the fluids fluxile. 3. To promote gently the excretions by stool, urine, the skin, and spittle. 4. To assist and restore the lost strength.

To prevent the putrid dissolution of the humours, direct vinegar, the juices of oranges and lemons, and syrups of the same; spirit of vitriol, spirit of salt, spirit of nitre, especially those that are dulcified.

To abate the acrimony, absorbent, testaceous, and bezoardic powders will be proper. To dilute at the same time, you may order a decoction of barley with scorzonera and shavings of hartshorn; as also the syrup of orange-juice, chicken-broth, and the like.

To promote the cuticular excretions, give diaphoretic simple waters, alexiterial waters, with the tincture of valerian root, or snake root. To assist the excretions by stool, common domestic clysters will be useful; or those made of a decoction of barley, oil of sweet almonds, camomile flowers, elder flowers, syrup of violets, common salt, or nitre.

Or you may order the following laxative, which must be given with caution.

Take 2 ounces of manna, a dram of cream of tartar, 3 ounces of scorzonera water, half an ounce of syrup of violets, 3 drops of oil of juniper. Mix and make them into a draught.

To raise the spirits and restore the strength, a little wine will not be improper, with hartshorn jellies, China orange or Seville orange juice with sugar.

A congruous regimen in these diseases is of very great consequence; for if the patient is kept too hot, the dissolution of the blood will be promoted, a costiveness will be induced, the anxiety will be increased, the impure salt and acrid humours will be actuated, the strength will be exhausted, the sweating will be too speedy and profuse, and spots will appear on the skin. On the other hand, if cold is incautiously admitted, especially to the feet, perspiration will be checked, the eruptions and spots will be driven back: There will be griping pains, a looseness, and the critical evacuations will be disturbed. All sudden changes from hot to cold, or cold to hot, are equally bad. A temperate regimen is best. However, care should be taken that the patient does not breathe his own atmosphere full of morbid exhalations, so very prejudicial to health; but the air should be drawn out of the room, and fresh admitted.

The perspiration should constantly be kept up, and the linen of any kind should not rashly be changed, nor should the patient be removed from one bed to another. He should be enjoined not to rise frequently. And if the bed-cloaths are wet and must needs be changed, let them be well-aired, and pretty much worn.

An erect posture of the head and body is to be shunned either in or out of bed, especially if the pulse is very weak and the strength little; as also when the disease is near the state

The mind should be kept as cheerful as possible, and all occasions shunned of exciting anger, fear, terror, or pusillanimity in the patient. His hope of recovery should

be kept up as much as possible, instead of being terrified with the prediction of death.

It is an undoubted axiom, that all strong medicines are hurtful in this disease; such as emetics, purgatives, and diuretics; as also sudorifics of too spirituous a nature: But temperate and moderate things are very useful.

It must be remembered likewise, that these fevers have certain types and periods, and exacerbations and remissions at certain times; which a physician should always carefully observe. In the frebile heat, and when the symptoms are most intense, humectants, diluents, and the absorbent nitrous powders abovementioned will be most proper, with a very moderate external regimen. When the pyroxyfm is ended, the skin lax, more soft, and disposed for excretions; then analeptics, medicines that stimulate; and if there is occasion, bezoardics, and things that promote perspiration; as also the infusion of veronica, scordium, and liquorice, drank as tea, are likely to do the greatest service. And because a diarrhoea frequently carries off the disease, it is never to be stopt, especially about the critical times, neither with astringents, sedatives or opiates: But if nature tends to this excretion, and is too sluggish, she is to be assisted by the laxative draught above described, with the addition of tamarinds.

There is no evacuation so dangerous as bleeding at the nose; for then there is a congestion of blood in the head from the spasms of the lower parts. However, if the flux of blood is moderate, and the body abounds with it, instead of being hurtful, it will relieve the head, though this seldom happens. When there are a few drops only without alleviation, they portend a delirium and an inflammation of the fauces: But when the flux is copious, the strength will diminish, and the eruptions return inwards not without danger. Therefore, to prevent a conflux of blood to the head, the feet must be always kept in a moderate heat and moisture; mild blisters should be laid to the calves of the legs, and the body should be opened with clysters or solutions of manna. These will also be serviceable when the hæmorrhage is too large. But when it is too little, and the eyes look red and wild, with a strong pulsation of the temporal arteries, besides the former, it will be proper to apply cupping-glasses to the nape of the neck, or to thrust a straw up the nose to cause it to bleed, or to use a scarifying instrument.

Bleeding in these fevers must be used with great circumspection; for it is much more proper as a preservative than a cure. But when the disease has made its onset with great loss of strength, complicated with catarrhal disorders, and when putrid and malignant fevers are rise, it must be always omitted. If the stomach has lately been surfeited with incongruous aliment, a grain or two of tartar emetic in a solution of manna will be necessary. Blisters will be of great use when a retrocession of the eruptions is apprehended, when the excretions are slow, and when there is a sleepiness and torpor; in which cases, they may be laid to the arms and calves of the legs.

#### *Of the Malignant, Goal, and Spotted FEVERS.*

THE true spotted fevers are very malignant, contagious, and detrimental to the head and strength, attended with spots of various colours, arising from a corruption

of the vital fluids, and a putrid dissolution consequent thereupon.

These petechial fevers are deservedly called malignant, or poisonous, as they generally proceed from a most subtle, active, virulent vapour, or miasma, which is infectious. At first they often seem mild and gentle, and have the appearance of catarrhal fevers; but they soon exert their virulent effects in a most fatal manner.

At first the patient complains of great weakness and loss of strength, and is apt to faint away.

The head aches, and from the very beginning is hot, dull, attended with a dejection of mind. There is constant watchfulness; the appetite is lost; the pulse is languid, small, and unequal; there is an oppression of the breast, sometimes a dry cough, an undulatory and tremulous twitching of the muscular and tendinous fibres, with a subfultus tendinum. Many neither complain of heat, nor pain, nor anxiety, and assert that they feel nothing bad, but weakness and want of sleep. The urine is generally thin at first, and like that of sound people. On the fourth, fifth, or the seventh day, the spots appear principally on the back and loins, of various colours, generally without relief; wherefore they are rather symptomatic than critical.

Huxham says, these fevers attack with much more violence than the slow and nervous; and the rigors, if any, are greater, the heats sharper and more lasting, yet at first sudden, transient, and remittent; the pulse more tense or hard, but commonly quick and small, though sometimes slow and seemingly regular for a time, and then fluttering and unequal. The head-ach, giddiness, nausea, and vomiting, are much more considerable, even from the very beginning. Sometimes a severe fixed pain is felt in one or both temples, or over one or both eye-brows, frequently in the bottom of the orbit of the eyes. The eyes always appear very full, heavy, yellowish, and often a little inflamed. The countenance seems bloated, and more dead-coloured than usual. Commonly the temporal arteries throb much, and a tinnitus aurium is very troublesome; a strong vibration also of the carotid arteries comes on frequently in the advance of the fever, though the pulse at the wrist may be small, nay, even low: This is a certain sign of an impending delirium.

The prostration of spirits, weakness, and faintness, are often surprisingly great and sudden; sometimes, when the pulse seems tolerably strong, the respiration is very laborious, and interrupted with a kind of sighing or sobbing, and the breath is hot and offensive.

There is generally a sort of lumbago, or pain in the back and loins, a weariness, soreness, and pain in the limbs. Sometimes a great heat, load, and pain at the pit of the stomach, with a perpetual vomiting of porraceous or black bile, of a nauseous smell, with a troublesome hiccup.

The tongue at the beginning is white, but grows daily more dark and dry, or of a shining; livid colour, with a kind of bubble at the top; sometimes exceeding black for many days: At the height, it is generally dry, stiff, and black, and the speech scarcely intelligible.

The thirst, in the increase of the fever, is commonly very great, sometimes unquenchable; and all the drinks seem bitter and naukish; at other times there is no thirst,

though the mouth and tongue are exceedingly foul and dry; this is a dangerous symptom, and ends in a phrenzy or coma. The lips and teeth, near the state, are furred with a very black tenacious fordes.

At the onset of the fever, the urine is often crude, pale, and vapid; but grows to so high a colour as to resemble a strong lixivium, or citron urine, tinged with a very small quantity of blood: it has no sediment, or cloud, for many days together; but by degrees grows darker, like dead strong beer, and smells offensive.

The stools, especially near the state, or in the decline of the fever, are for the most part very offensive; green, livid, or black, frequently with severe gripes or blood. When they are more yellow or brown, the less is the danger: but the danger is greatest of all when they come away insensibly. If the belly be hard, swelled, and tense, it is a very bad symptom. A gentle diarrhoea is often very beneficial, by which nature carries off the morbid matter.

The more florid the spots are, the less is the danger; and it is a good sign, if the black or violet become of a brighter colour. The large, black, or livid spots, are almost always attended with profuse bleedings. The small dusky, brown spots, like freckles, are almost as bad as the livid and black. Sometimes they are attended with profuse, cold, clammy sweats; at which time the spots vanish without any advantage.

The eruption of the spots is uncertain; sometimes they appear on the fourth or fifth day; sometimes not till the eleventh, or later. The *vibices*, or large livid or dark greenish marks, seldom appear till very near the fatal period. Sometimes about the eleventh or fourteenth day, when the sweats are profuse, the spots disappear, and vast quantities of small, white, miliary pustles break out. If there is an itching, smarting, red rash, it commonly greatly relieves the sick, as well as large, fretting, watery bladders on the back, breast, and shoulders. A scabby eruption about the lips and nose is a salutary symptom; the more hot and angry the better. Brown dark aphthæ are more uncertain and dangerous, as well as those exceeding white and thick like lard. They are followed with difficulty of swallowing, pain and ulceration of the fauces and œsophagus, with incessant hiccup; the whole *prima viæ* are at length affected, a bloody dysentery comes on, and a mortification of the intestines.

Pringle observes, that in hospital, goal, or camp fevers, the first complaints are gentle horrors, and little feverish heats, alternately succeeding each other, with loss of appetite; the disorder being greatest at night, the body is hot, the sleep interrupted and not refreshing. They have constantly some pain and confusion in the head, chiefly about their forehead; the pulse is at first but little quicker than the natural, and the drought, if any, is inconsiderable. They are too ill to mind business, and too well to be confined. In this state, a change of air, with a vomit and sweat, will perform a cure; yet a large bleeding at this time will sink the pulse, and bring on a delirium.

When the symptoms come on quick and violent, the fever seems to be inflammatory, and can only be distinguished by a knowledge of the circumstances; and bleeding yields

no relief, but exasperates the complaints. The aforesaid symptoms are now more high, with great lassitude, nausea, and pains in the back, with pain and confusion in the head, and great dejection of spirits.

The pulse at this time is generally quick and full: now a moderate bleeding affects the pulse but little; if large, it will sink, and bring on a delirium. The worst kind of blood is when the crassamentum is dissolved, which is a sign of high putrefaction.

If the patients lie warm, the body is generally costive; if cold, there is a diarrhoea. If they have bilious stools when they are warm, they are critical, and not to be checked unless immoderate. In the worst kind of these fevers, in the last stage, a diarrhoea commonly carries the patient off; but then the stools are involuntary, colliquative, ichorous, or blackish, and of a cadaverous smell, which are the effects of a mortification in the bowels.

The heat of the body at first is not considerable: but if the pulse is felt for a while, there is an uncommon heat, which remains upon the fingers some minutes afterwards. A day or two before death, the extremities feel quite cold, and then the pulse is hardly to be distinguished.

The skin is generally dry and parched; yet in the beginning there are often imperfect sweats, without any relief. A continued and generous sweat is the surest cure.

The tongue is generally dry, hard and black, with deep chaps; but towards the last it is soft and moist, and the colour is a mixture of green and yellow. The drought is sometimes great, at other times very little.

Some preserve their senses through the course of the disease, except a confusion and stupor; but few keep them till death, if it prove fatal. They sleep seldom and seem to be pensive and in deep thought. The face is not ghastly nor morbid, till towards the last. The confusion of the head often rises to a delirium, especially at night, but seldom changes to rage. A tremor is more common than a subsultus tendinum. The pulse sinks all along, the stupor or delirium and tremor increase, and the spirits are relieved in proportion to its rising to the head. Frequently the patient is dull of hearing from the very beginning, and at last grows almost deaf.

When the delirium is at its height, the face is commonly flushed, and the eyes red, unless after large evacuations; then it appears meagre; the eyelids in slumbers are only half shut; and the voice, which is constantly slow and low, sinks to a degree scarce to be heard.

When the fever is protracted with a low pulse, they have a particular craving for something cordial; and nothing is so acceptable as wine. They long for no food; but will take panada, if mixed with wine.

There are spots, but not always. In hospitals they are less usual at the first breaking out of the disease; but when the air is more corrupted, the spots are common. They are of the petechial-kind, of an obscure red, paler than the measles, not raised above the skin, of no regular shape, but confluent. These spots are very irregular, sometimes appearing on the fourth or fifth day, and at others on the fourteenth. They are neither critical nor mortal signs, but dangerous; if purple, they are more ominous, but not absolutely mortal. In a few cases there have been purple streaks and blotches. These sometimes,

as well as the spots, do not appear till after death. This fever, on account of its exacerbations at night, may be looked upon as the lowest degree of the remitting kind.

The duration is uncertain, and in proportion to the virulence. Their course is generally from fourteen to twenty days: some have died or recovered after four weeks. When the course is long, it commonly terminates in abscesses of the parotid or axillary glands, sometimes in an hectic: Some, after this fever is over, fall into an irregular intermitting; many complain of a pain in their limbs, and want of rest; and almost all of great weakness, confusion in their heads, and noise in their ears. When the air is highly malignant, the disease terminates, in five or six days, either in death or a critical sweat.

The most peculiar symptoms of this disease, are always a singular attack upon the head, as a stupor, or pain; and if it lingers, a slow low voice, and sinking of the spirits, without any large evacuation; pale urine, petechial spots, the bad effects of large bleeding, or too many clysters; lastly, the disagreement of cooling medicines, excepting in the beginning; and on the other hand, the agreement with wine, volatiles, and other cordials, during the greatest part of the disease.

As to the prognostics, the spots are so far from being salutary, that the more plentiful they are the greater is the degree of the corruption: when they are livid, lead-coloured, and of a greenish black, they shew a sphacelous corruption. Those who escape are not freed by a cutaneous excretion, but by large sweats, breathing a stinking acor; or by critical fluxes of the belly; which happen by the benefit of nature, when the corruption of the fluids is not great. Many are apt to fall into a sphacelous corruption of the stomach, intestines, and other viscera, or into a phrensy, or more frequently into an anginous inflammation of the fauces and oesophagus, as appears from the intolerable smell which happens after death. This unhappy event is presaged, if there is no thirst, or one that is unquenchable; if the tongue is dry, chapt, black; the fauces inflamed and beset with sordes, with difficult swallowing; if, after the eruption of the spots, a difficult breathing and straitness of the breast remains and gains ground; or if a delirium increases after sweating, and a flux of the belly, the urine being at the same time turbid, and depositing no sediments; lastly, if the eyes are dim, the patient catching at straws; if there is a subsultus tendinum, if the excrements come away insensibly, or if there is a cold sweat with convulsions,

Pringle observes, that those who are weakened by other distempers, or their cures, are more susceptible of the goal or hospital fevers than the strong and vigorous; and that one who is recovered is more subject to relapse, than he who is to be first attacked.

All the prognostics, says he, taken singly, are uncertain. The following signs are good: to have no delirium; to have the pulse neither very low nor quick, or, if sunk, to have it rise by wine or cordials, with an abatement of the delirium; and to have the tongue moist, and of a natural colour. It seems peculiar to this fever, that deafness is generally a good sign. The natural and best crisis is by sweat, when the pulse rises, and the symp-

toms abate; next to that is an insensible perspiration, which is known by the softness of the skin, moisture of the tongue, and a remission of the other symptoms. Bilious stools, with turbid urine, and a moist tongue, may be considered as signs of a favourable crisis. But the contrary of all these are bad; as also the subsultus tendinum, inflamed eyes, and great anxiety. It is observed to be among the worst signs, when the patient complains of blindness, or when he cannot lie but on his back, and pulls up his knees; or if, when insensible, he endeavours to uncover his breast, or makes frequent attempts to get out of bed. If there are ichorous, cadaverous, and involuntary stools, it is a sign of certain death.

The formal ratio of these pernicious fevers, consists in the putrid dissolution or colliquation of the blood and vital fluids, especially of that highly elastic fine fluid which is contained in the blood, and separated in the brain and spinal marrow, by which it is distributed by the nerves to all the body, indued with sense and motion, for it greatly vitiates and desiles this liquid. However, such is the nature and power of that poisonous vapour, by which sound bodies are infected, that it not only induces a putrid fermentation into the blood and other fluids, but acts immediately on the inward and nervous parts of the brain, which it corrupts, and produces a languor in the vital and animal powers, even while the state of the blood and humours remain free from corruption.

This virulent vapour enters the body by the nostrils, fauces, and bronchia; whence it immediately reaches the nerves in the brain, and renders the patient light-headed, with a dulness of the head, and a loss of strength, and a vertiginous affection. It likewise mixes with the saliva, descends into the stomach, which is a nervous part, and there takes up its principal residence; whence the bad symptoms generally appear first in the stomach and præcordia, with a nausea and an inclination to vomit, as also a diarrhoea with gripes, or a costiveness, with loathing of food, anxiety of the præcordia, and watery eructations from the stomach.

Hence the reason evidently appears, why nothing is more proper to guard against this disease than turning away one's face from the patient, frequent spitting, chewing angelica, zedoary, or pimpnel, and smoking tobacco: hence likewise appears, why the force of this poison is exerted in the stomach, which is beset with copious crudities, and pituitous and salival fordes; and likewise why gentle emetics, joined to alexipharmics, commonly destroy the disease in the bud.

It may be induced by a bad state of the air: for a long moist, rainy, cloudy, and southerly state of the air, dulls and depresses the motions of the solids and fluids necessary for life: to this may be added a long and frequent inundation of water, which is apt to generate putrid diseases; as likewise the exhalations arising from putrid unburied bodies, or from the excrements of animals, especially if confined and shut up from the air.

In the regimen, it is necessary, if possible, to breathe a serene, temperately warm air. The room should not be heated too much, it being found to be hurtful. The patient should eat nothing solid in the decline of the disease, nor after it. A free use of food, of nourishing

and comforting broths abounding with oleous particles is pernicious, especially about the critical days, in the state of the disease, or where there is any critical evacuation. Nothing is more hurtful than an erect situation.

Alexipharmics, volatile salts, hot and spiritous bezoardics, are hurtful, especially with a hot regimen: for they dissolve the blood, and increase the number of spots; or cause head-achs, inflammations, or copious sweats.

Bleeding has been good in plethoric bodies, and in those who have been accustomed to hæmorrhages; on the contrary, if the patient is low or weak, bleeding is hurtful.

Gentle vomits are useful by way of prevention, and in the very beginning of the disease; but in the progress and state have had a bad effect.

Blisters have been greatly praised in the state of the disease, when there has been a delirium, a sopor and convulsions, being applied to the neck.

We reject all opiates and soporiferous medicines, on account of the pulse and want of strength; because they retard the excretions, increase the malignity, and so hasten death.

The medicines used are elder-flower water, that of limes, elms, roses, of the tops of scordium, scabious, and carduus benedictus; as also syrups of citrons, pomegranates, and the juice of roses; powders of mother of pearl, diaphoretic antimony, crabs-eyes, amber, terra sigillata, burnt hartshorn, pure nitre. Alexipharmics are, camphire, essence and extract of scordium, vincetoxicum, the bezoardic spirit and tincture, the essence or spirit of vitriol, and dulcified spirit of nitre: Moisteners, the decoction of scorzonera, shavings and jelly of hartshorn: Analeptics, orange-flower water, fresh oil of citrons, with sugar, confection of alkermes, and balsam of life: Antispasmodics, essence of castor, cinabbar, and succinated spirit of hartshorn.

In the beginning of the disease, use a bezoardic powder of nitre, and a little camphire, often repeated; in the progress and state of it, a mixture of temperate waters, diaphoretics, analeptics, antispasmodics, and cordial bezoardic powders, with a little juice of citrons. In the drink put nitre, or philosophic spirit of vitriol, or sulphurated clyffus of antimony, to keep the body open. Also give drink of the filtrated decoction of hartshorn, and root of scorzonera, either hot or cold. About the critical day give gentle alexipharmics, with things to promote sweat when nature seems to tend that way.

This is the best and surest method of cure. But if the vomiting is too great, with an anxiety of the præcordia, and profuse diarrhoeas, accompanied with gripes, apply outwardly Venice treacle, expressed oil of nutmegs, camphire, oil of cloves, and balsam of Peru, mixt together, to the region of the stomach. If a diarrhoea exhausts the patient too much, give a nitrous bezoardic powder, with a little camphire, and theriacæ cœlestis. If the body is costive, with gripes, prescribe lenient clysters, or such as are made entirely of oil. To raise the strength, allow spiritous things such as comfort and are aromatic; but they must be externally applied to the pulses or pit of the stomach, or nostrils. To quench thirst, give an electuary of Muscovada sugar and dulcified spirit of nitre,

Nature

Nature many times strives in vain to discharge the irritating matter, by vomit, without the assistance of art; and therefore something to promote it will render it much easier; which may be done by an infusion or decoction of ipecacuanha, or oxymel scilliticum, with a slight infusion of camomile flowers.

The primæ viæ should be unloaded by very gentle methods, such as clysters of milk, sugar and salt; laxatives of manna, cream of tartar; Glauber's purging salt, tamarinds, and rhubarb.

When there are signs of redundancy of the bile, it should be forthwith discharged by vomit or stool, as nature points out; which is often succeeded by an amazing change for the better, where an inexpressible anxiety, load on the præcordia, perpetual sickness, eructation, and singultus, had preceded.

Between the seventh and fourteenth day, nature endeavours to relieve herself by vomit, or more frequently by loose stools; then given a gentle laxative the eighth and ninth day, unless some eruption appear, or a kindly sweat forbid it.

But the constant and grand effort of nature, is to throw off the putrid malignancy through the pores of the skin. If it be a breathing sweat at the state of the disease, and the pulse grows more open, soft, and calm, a little before and during its continuance, it is always salutary; but if it be profuse, cold, clammy, or partial, about the head and breast only, the sign is not good. Profuse sweats in the beginning are generally pernicious, especially if a *rigor* supervenes.

Sweats should never be forced by violent hot medicines, regimen, &c. Plentiful subacid diluents will be sufficient, and gentle cordial diaphoretics.

As acids and subastringents are given to preserve the crasis of the blood and tone of the vessels, and to prevent the farther putrefaction of the humours, diaphoretics, especially camphire, should be joined with them.

Dr Brookes used the following prescription of the bark for many years with success, not only in intermittent and slow nervous fevers, but also in the putrid, pestilential and petechial, in the decline, though the remissions have been very obscure; but if the patient is costive, or hath a tense or tumid abdomen, he premised a dose of rhubarb, manna, or the like.

Take two ounces of Peruvian bark in powder, an ounce and a half of orange-skin, 3 drams of Virginian snake-root, 4 scruples of English saffron, 2 scruples of cochineal, and 20 ounces of spirit of wine. Mix and infuse the ingredients in a close vessel for three or four days, and then filtrate the infusion.

Of this give from a dram to half an ounce every fourth, sixth, or eighth hour, with ten, fifteen, or twenty drops of elixir of vitriol, out of any appropriated draught, or diluted wine. The above composition tends to strengthen the solids, to prevent the farther dissolution and corruption of the blood, and in the event to restore its crasis.

With this view also give a generous red wine, as a most noble, natural, subastringent cordial, which is of high service in the state, but more especially in the de-

cline of these fevers, acidulated with the juice of Seville oranges or lemons, as also with cinnamon, the rind of Seville oranges, and the like, to which a few drops of elixir of vitriol may be added. Rhenish and French white wines, when diluted, are also a most salutary drink, and generous cyder is little inferior to either.

#### Of the PESTILENTIAL FEVER.

A pestilential fever is a most acute one, arising from a poisonous miasma, brought from eastern countries; and unless it is immediately expelled out of the body, by the strength of the vital motions, by buboes and carbuncles, it is fatal.

It differs from other contagious, malignant, and eruptive fevers, because it is the most acute; for it sometimes kills on the first, and sometimes on the second day. Besides, in our climate it is not epidemic or sporadic, from a bad way of living, or unhealthy air; but happens when it is most salutary, from contagion alone. There is something very singular in this infectious miasma; for though it is apt to spread at a strange rate, yet it will abate by intense cold, and be plainly extinguished: wherefore in a cold season, and very cold countries, it either does not appear at all, or in a very mild degree; whereas if the climate is hot, it is not only most vehement, but most common.

In this, as in all other contagious diseases, the venomous miasma is swallowed in with the air, and insinuates itself in the salival juice, where its tragedy is first acted. Whence it assaults the head, brain, nerves, and animal spirits, producing a torpor in the head, a heaviness, a sleepiness, a violent pain, a stupor of the senses, a forgetfulness, inquietude, watching, and loss of strength. From the fauces it proceeds to the stomach, creating loathing of food, nausea, anxiety of the præcordia, a cardialgia, attended with fainting, reaching to vomit, and vomiting itself. Hence it proceeds to the membranes of the spinal marrow, and the coats of the arteries, producing horrors, a languid, small, contracted, quick pulse, and even fainting. All these are generally signs and symptoms of the plague; which are of a more violent and quick operation, in proportion to the virulence of the pestilential miasma.

All plagues are not of the same nature, but vary according to different constitutions and circumstances. Those who have written of the plague universally agree, that spongy and porous bodies of an obese habit, of sanguine and phlegmatico-sanguine constitutions; women, young persons, and children; persons of a timid disposition, that are poor, live hard, or are given to luxury, and sit up late at nights; are more apt to be afflicted with this disease, than the strong and intrepid, lean, nervous; those induced with large vessels; men, or old persons obnoxious to the hæmorrhoidal flux, and who have issues and open ulcers. Nothing brings on this distemper more than fear, dread of death, and a consternation of the mind.

Pestilential fevers are so called, when the patient falls into sudden weakness: for it is a kind of malignant fever, attended with more grievous symptoms; the patients die in a short time, that is, in two, three, or four days, and sometimes sooner. If malignant fevers arise in war-time

among;

among the foldiers, they are called camp-fevers; in Hungary, an Hungaric fever. But the plague, or pestilence, is known when buboes and carbuncles arise in various parts of the body. The sweating sickness had its rise in England, in which the patient fell into a violent sweat, of which many died in a day's time.

The pestilential poison disturbs all the functions of the body; for unless it be expelled to the external parts, it is certainly fatal. Nor is this to be done as in other fevers, by large sweats, by stools, by a flux of urine, by customary evacuations of blood, or by bleeding at the nose, either natural or artificial, for they rather hasten destruction. The salutary and critical excretion which perfectly solves the pestilential disease, is by tumours in the surface of the body not otherwise than the erysipelas, between the third and fourth day; and the sooner the better, for then the symptoms are mitigated. The pestilential tumours are of two kinds; the first arises in glandulous places, most commonly in the groin and arm-pits, sometimes in the parotid and mammary glands, as also the lower maxillary, under the chin, and in those near the aspera arteria. It is a hard, painful, tense swelling of the glands, with great heat; and if they are salutary, being swoln, they grow soft, and suppurate. The other sort is the anthrax or carbuncle. Celsus describes it in this manner. It is a swelling on which there are pustules, which rise but little; they are black, sometimes sublivid or pale. In this there seems to be a faniy; it is black underneath. The body itself is more dry and harder than usual. There is as it were a crust about it, surrounded with an inflammation; nor can the skin be raised up in the part, but is joined to the flesh underneath. Mindererus, who was present at the plague, says, that a carbuncle is of the size of a grain of mustard-seed; and about its edge, there is a circle, or burning halo, of a large size. The flesh which it seizes is like an eschar or putrid flesh, and falls off as if torn out by a wolf. No part of the body is free from these carbuncles; but they generally lay hold of the membranes of the muscles, and the nervous and fibrous substance of the skin, especially in the back, arms, and thighs. At first there is an exquisite itching in the part; which when scratched, pustules arise; they are of a red, livid, or whitish purple colour, or sometimes black. When the pustules are pressed, they seem to be full of pus; under which there is an ash-coloured crust, which being taken away, the flesh appears corrupted and spongy, with intolerable pain and burning of the circumjacent flesh, which is followed by a mortification of the part.

When the plague is fatal, some die of a fainting the first or second day. But in many, when the poison is not expelled, or, if expelled, returns back, it brings on a mortification of the nervous coats of the noble parts, of the pleura, oesophagus, stomach and intestines, or the meninges of the brain; which creeps speedily to all the viscera, and the blood itself; whence the carcases swell, and have a most intolerable stench. Sometimes, when the pestilential tumours are too plentiful, they die of a symptomatic fever, from the inflammation, pain, and intolerable heat.

It has been before remarked, that the plague is not a native of our country, but is brought from remote pla-

ces: whence the best preservative is to fly to a distant country; for the same reason, those princes best consult the welfare of their subjects, who in the time of the plague endeavour to prevent the spreading of the infection, and, when a family is afflicted, separate the well from the sick, and burn all their moveables. While this disease reigns, all persons should live temperately, avoid an excess in the use of the non-naturals, and abstain particularly from violent affections of the mind, and every thing else that dejects the strength, disturbs perspiration, and generates crudities in the *primæ viæ*; the mind is especially to be supported, and fear, dread, and pusillanimity are to be banished; for more die of terror than of the plague itself.

As in the small-pox, the management consists in clearing the *primæ viæ* in the beginning, in regulating the fever, and in promoting the natural discharges; so in the plague, the same indications will take place. In the plague, indeed, the fever is often much more acute; the stomach and bowels are sometimes inflamed, and the eruptions require external applications, which to the pustules of the small pox are not necessary.

When the fever is very acute, a cool regimen is necessary; but when the pulse is languid, and the heat not excessive, moderate cordials must be used. The most gentle emetics may be given; the best is ipecacuanha, if the stomach or bowels are not inflamed, for then certain death must be expected.

As for the eruptions, they must be brought to a suppuration as soon as possible; and as soon as they appear, fix a cupping-glass thereon, without scarification; and when that is removed, apply a suppurating cataplasm, or plaster of warm gums.

If the tumors will not suppurate, as the carbuncle seldom or never does; yet if a thin ichor or matter exudes through the pores, or if the tumours feel soft to the touch, or, lastly, if it has a black crust upon it, then it must be opened by incision, either according to the length of the tumor, or by a crucial section. If there is any part mortified, as is usual in the carbuncle, it must be scarified. Then it will be necessary to stop the bleeding, and dry up the moisture with an actual cautery, dressing the wound afterwards with dressings and pledgits, spread with a common digestive.

The next day the wound ought to be well bathed with a fomentation of warm aromatic plants, with spirit of wine in it, in order, if possible, to make it digest, by which the sloughs will separate. After this, the ulcer may be treated as one from a common abscess.

But the patient runs great hazard in this way, notwithstanding the utmost care; therefore artificial discharges for the corrupt humours should be attempted. To this purpose, large bleeding and profuse sweating are recommended to us upon some experience.

As for sweating, as Sydenham advises, it must be continued without intermission.

If there is a vomiting, the patient should be made to sweat with the weight of the bedcloaths alone, drawing the sheet up to his face.

When the sweat is begun, it should be promoted with sage posset-drink, or small-beer, in which mace has been boiled,

boiled, repeating them pretty often for twenty-four hours; in the mean while, the spirits of the patient are to be kept up with comforting broths. The by-standers should forbear to wipe off the sweat, nor should the patient change his linen all that time, which is a necessary caution; if it be stopped before that time, it will be to no manner of purpose; during the sweat, the diarrhœa, if any, and the vomiting, will stop of their own accord.

Theriaca, and the like solid medicines, being offensive to the stomach, are not the most proper sudorifics. An infusion of Virginia snake-root, in boiling water, or, for want of this, of some other warm aromatic, with the addition of about a fourth part of aqua theriacalis, is safer.

Those who are obliged to be near the sick, must take care that the miasmata do not approach their vital juices, nor yet the salival. To this purpose, frequent spitting, and washing the mouth with vinegar, or wine, or snuffing them up the nose, are useful. The efficacy will be still greater, if they are imbued with rue or citron rind. For an acid is the genuine antidote of a putrid and sulphureous miasma. Wherefore it is much safer to hold acids in the mouth, than alexipharmic roots. It will be likewise proper to get a few spoonfuls of Rhenish wine, or bezoardic vinegar, diluted with water or wine, and so take them. The Turks deal much in the juice of lemons.

When the plague is actually begun, and the body is costive, a gentle clyster should be used. Then a sweat should be promoted (twenty-four hours at least,) that the poison may exhale and pass through the skin; and epithems to the heart will not be without benefit, though they reach only to the right orifice of the stomach, and its nervous coats; they may be made of *theriac*. expressed oil of nutmegs, camphire, saffron, castor, and balsam of Peru. But above all, acids are highly praised; such as, juice of citrons, Seville oranges, lemons, vinegar, &c. which resist poison, putrefaction, and prevent the dissolution of the blood.

When the strength of the disease is vanquished, gentle laxatives will be proper to expel the sordes during the course of this disease.

It is worthy observation, that few medicines are best; for which reason people of the lower class generally come off better than persons of distinction; and there is nothing worse than to give alexipharmics abounding with a hot volatile oil; much less ought volatile spirits to be given, for they fix the poison upon the nervous parts. Yet herbs and roots of this kind are not altogether to be condemned, if mixed with acids and nitre. A mixture of *carduus benedictus* water, and wine vinegar, when given to four spoonfuls, with a dram of crabs-eyes and theriaca, and repeated, were very useful in the plague at Hall in 1682. In the plague likewise in Lombardy, 1526, many recovered with the juice of goats-rue, vinegar, water of *carduus benedictus*, and a little *theriac*. given to make the patient sweat: and Thoner observes, that nothing was of any advantage in the plague except theriacal vinegar given in the beginning to promote a sweat. And in the year 1544, when a malignant fever raged among the soldiers, a whole regiment was saved, to whom this vinegar was given in due time, except a very few. And in

the plague at Rome, vinegar with rue, pimpernal root, betony, garlick, and juniper-berries, with a little camphire added to the infusion, caused many to escape. Likewise the preservative water of Sylvius has been greatly esteemed, because of the vinegar. And Mindererus asserts, that unless alexiterials be given within twenty-four hours, all medicines are vain.

#### Of the MILIARY FEVER.

A miliary fever is not unlike a cattarrhal, and is attended with a more intense motion of the vascular and nervous system, whereby a corrupt lymphatic matter of a peculiar nature is expelled from the inward, and more especially the nervous parts, to the surface of the skin, in the form of small, rough, miliary pustules, sometimes red, and sometimes white.

These small pustules are exceeding numerous, causing a corrugation, roughness, and dryness of the skin, and have a fetid smell peculiar to themselves. There is no eruption so inconstant as this, for it will sometimes strike in suddenly, and as suddenly appear again, and is attended with an itching pricking sensation more than any other kind. Other eruptions are common to all countries, and are equally vexatious to men as well as women; but the miliary seems familiar and endemic to some places only, and more frequently attacks the female sex, especially in child-bed. It is neither epidemic nor contagious, and seems rather owing to a fault in the viscera and fluids, than the intemperature of the air.

The miliary eruptions are either red or white, and are both more or less acute, benign or malignant. The red are less dangerous, are generally free from a fever, and then are chronic, appearing at stated seasons of the year; but sometimes they are accompanied with an acute fever. The white seldom or never appear without a fever, and therefore are more dangerous. In these the lymph is affected with a kind of acidity; for the patient discharges plenty of serum by sweat, urine, stool or salivation, which are the effects of an acid which coagulates the thicker part of the blood, and separates the serum from it. Besides, all kinds of acids and refrigerants, not excepting nitre, freely taken, are most hurtful in this disease. On the contrary, absorbents and anti-acids, and things which render the blood spiritous, are most salutary. Women who eat much fruit, and such like trash, of the acedent kind, and live idle sedentary lives, are most subject to this disease.

Sometimes the miliary eruptions are idiopathic, and sometimes symptomatic, and supervene to other fevers, especially the continual, when on the decline. They likewise appear very commonly with the measles, small-pox, putrid and spotted fevers, when drawing towards an end; and then they raise a new fever, whose attack the debilitated patient is not able to stand.

The idiopathic begins with a slight shivering, succeeded with heat and loss of strength, sometimes even to fainting. There is a straitness about the breast, attended with anxiety and deep sighs, restlessness and watching. There is a pricking kind of a heat perceived in the back, with an alternate succession of cold, shivering, and heat under the skin, but most sensible in the palms of the hands.

hands. Women in child-bed have the flux of the lochia stopped, and the milk recedes from their breasts. To these succeeds a roughness of the skin like that of a goose; and a great number of pustules appear, sometimes white and sometimes red, or both together, of the size of millet (or mustard) seed. They first beset the neck, then the breast and back, and afterwards the arms and hands. When these begin to rise on the surface of the skin, the more grievous symptoms cease. The pulse, which before was hard, contracted and quick, grows more soft, free, and slow; the dejection of mind goes off, the skin becomes moist, and the belly, which was bound so much that the patient could not break wind, now spontaneously admits him to go to stool. Afterwards the pustules ripen, and are full of a stinking ichor. The urine appears more saturated, and a singular fetid sweat, proper to this disease, breaks forth; the flux of the lochia in females returns, and within the space of seven or eight days the pustules disappear, with great itching in the extreme parts, drying up and falling off in scales. Then the patient recovers strength, and regains health.

It is hard to determine the day of the eruption of the pustules; but it is generally the tenth or eleventh day from the beginning, if the fever makes a regular progress; sometimes on the eighteenth, and sometimes on the twenty-first, or twenty-second day.

Bad signs are, when the miliary pustules appear and vanish by turns, and the symptoms continue violent; but it is worse if they quite disappear: Hence an oppression of the breast, with sighs, a straitness of the fauces, loss of strength, and great anxiety.

Fatal signs are, when the morbid matter not being thrown out again, there is an inward heat and the extreme parts are affected with cold and shivering, and there is a cold profuse sweat; or, on the contrary, when the extreme parts are hot, and a notable sense of coldness is perceived in the abdomen, then the patient dies in a fainting fit, arising from a mortification of the stomach, intestines, brain, or womb.

The cure of this fever depends on the following things. 1. To correct and temperate the acrid morbid matter which disturbs the nervous parts. 2. To relax the spastic strictures of the nervous fibres proceeding from thence. 3. To evacuate the prepared morbid matter through the pores of the skin, and prevent its striking in.

To dilute the sharpness of the humours, and to appease the irritation of the nervous parts, the following decoction may serve for common drink.

Take shavings of hartshorn, scorzonera root, and sarsaparilla, of each two ounces; and boil them in 6 pounds of water.

Let the patient be always kept in an equal moderate heat, and abstain from strong alexipharmics, and things actually hot, because they throw him into too profuse a sweat. But when there is an apprehension of the pustules striking in, then the decoction may be drank hot, with moderate expellents, as the exigence requires. Nor should the medicines be too cooling, because they increase the anxiety and faintness. In the red sort, when there is an internal heat, with thirst and a great pulse, diaphoretics with a little nitre will be proper; even though red

and white pustules appear together. But nitre alone should be used with caution, especially when there are signs of malignity. No malt liquor should be drank, but the former decoction.

The belly should be neither too much bound nor too open; yet even the gentle laxatives are not to be given till the pustules begin to dry; and then there is nothing else required but an emollient clyster.

Bleeding should be cautiously used; for when the weakness is excessive, the sweats profuse, and the pulse quick, it must be omitted. On the contrary, it is necessary for childbed women, when the lochia are suppressed, and the symptoms of a miliary fever begin to appear; but then it must be done speedily, and the great anxiety, fainting, and difficulty of breathing will cease, and the pustules break out.

Blisters on the back are very proper for this disease; for they help to draw off the impure ferous humours, and stimulate the fatigued nervous fibres to a contraction, so as to expel the morbid matter.

#### *Of the SCARLET FEVER.*

THE scarlet fever may happen at any season of the year, but it appears most commonly towards autumn. It reigns chiefly among children. It begins with coldness and shivering, as in other fevers, without any violent sickness. Afterwards the skin is covered with red spots, which are larger, more florid, and not so uniform as the measles. The redness remains two or three days, and then disappears; then the cuticle falls off, and leaves behind it a sort of mealy scales, scattered over the body, which appear and disappear two or three times.

Let the patient abstain from flesh, all hot cordials, and spiritous liquors; let him not go out of doors, nor be confined constantly to his bed; and then medicines will be of little use.

Apply a blistering plaister to the neck, and every night give a purgative of diacodium; and after the fever ceases, let the patient be purged with a very gentle cathartic, agreeable to the age and constitution.

#### *Of the MEASLES.*

THE measles are an eruptive catarrhal fever, generally epidemic, which by the increased vital motion of the heart and arteries throws on the skin an acrid, caustic, inflammatory matter, in the form of red spots. They begin with chilliness and shivering, and heat and cold succeed by turns. The next day the fever comes on with great sickness, thirst, and loss of appetite: the tongue is white, but not dry. There is a little cough, a heaviness of the head and eyes, and a continual sleepiness. There is a sneezing and a swelling of the eye-lids, a serous humour oft distils from the nose and eyes, which are certain signs the eruption is at hand. In the face the spots are small; but on the breast broad and red, not rising above the surface of the skin. The patient often has a looseness, with greenish stools.

These symptoms continue and increase till the fourth, sometimes the fifth day; at which time spots like flea-bites appear, increasing in number and magnitude, and in some places run together, rendering the face variously spotted.

spotted. These spots consist of very small red pimples, almost contiguous, and rising but little above the skin. They may be felt by a gentle touch of the finger, but the rising cannot easily be discerned by the naked eye.

From the face the spots gradually proceed to the breast, belly, thighs, and legs. The symptoms do not immediately vanish after the eruption, as in the small-pox, except the vomiting. The cough and fever increase, with difficulty of breathing. The weakness, and a defluxion on the eyes, sleepiness, and want of appetite, still continue.

On the sixth day, and sometimes sooner, the skin of the face and forehead begins to grow rough; and the cuticle breaking, the pustules die away; while on the rest of the body the spots are broad and red. On the eighth day the spots disappear in the face, and are scarce perceivable elsewhere. On the ninth they quite vanish; fine, thin, light scales, like flour, falling off from the skin at that time.

The measles in general are not dangerous, unless from an insalubrious epidemical constitution of the year, which sometimes renders them malignant. This may be known by a sudden loss of strength, coldness of the extreme parts, great restlessness, vomiting, difficulty of swallowing, and a delirium. If petechial spots or miliary eruptions supervene, there is great danger. A continual cough, a looseness, and great inquietude, are bad. Profuse sweats are no good sign. When the disease is ended, if the cough and hoarseness remain, a consumption and hectic will follow, without speedy assistance.

Those who die of the measles are generally suffocated on the ninth day. Some, when the disease is ended, have a looseness, which continues several weeks, and brings on a mortal *tubercle*: Some have a slow fever, with an atrophy and a swelling of the abdomen, which are fatal.

If children are suspected to abound with crudities in *primis viis*, it will be proper to evacuate with half a grain of tartar emetic, and syrup of succory with rhubarb. When there are worms, anthelmintics should be given. In adults abounding with blood, phlebotomy is necessary on the first days. Medicines too hot, and cold nitrous things, are equally hurtful. As soon as the eruption is ended a gentle cathartic is proper.

In a cough nothing is better than oil of almonds fresh drawn, mixt with syrup of capillaire; half a spoonful of which should be given often in water-gruel.

To absorbent and diaphoretic powders, half a grain of saffron may be added.

When this disease attacks women who are subject to hypochondriac or hysterical spasms, or when the menstrual flux is at hand, it is often attended with fainting fits, difficulty of breathing, with constrictions of the throat, and great anxiety of the præcordia. Therefore the eruptions are not to be driven out with hot remedies, but rather with such things as allay spasms, paregoric and carminative clysters, sometimes bleeding, as also a little castor and nitre mixt with bezoardic powders. By these means the spots will appear in a short time.

When a diarrhoea happens, it must be cautiously treated, and not hastily stopp'd; because it carries off a great deal of filth, and often puts an end to the disease. Then it

it will be best to wash the acrimony out of the intestines by demulcent clysters. But if, when the disease is over, the diarrhoea continues obstinate, it will be proper to add a few grains of the bark of eleutheria with bezoardic powders.

When there are hæmorrhages, which are generally signs of malignity, nothing must be used that is directly astringent, much less opiates and anodynes.

If the patient falls into too profuse a sweat, so that the linen is quite wet, it must be changed very cautiously for such as is well aired and warm, otherwise the spots will strike in. Many have been killed in a few hours, by a sudden change from hot to cold.

When the spots are gone, the patients should not expose themselves to the air; but be careful of their diet; otherwise they may fall into an asthma, suffocating catarrh, or consumption.

Sydenham, for the cough, orders the following.

Take an ounce and an half of the pectoral decoction; syrup of violets, and true maiden-hair, of each an ounce and a half: make them into an apozem, and take three or four ounces four times a-day.

Let the patient keep his bed for two days after the first eruption.

If, after the measles disappear, a difficulty of breathing, fever, and other symptoms, should supervene, resembling an inflammation of the lungs, let blood be taken away freely from the arm, once, twice, or three times, as occasion shall require; leaving a due space between each bleeding; and let the pectoral apozem above described be given, or oil of sweet almonds alone. About twelve days from the invasion, let the patient be purged.

#### *Of the SMALL-POX.*

THE small-pox is commonly divided into two kinds; the distinct and confluent.

The distinct sort begins with chillness and shivering, intense heat, a violent pain of the head and back, an inclination to vomit: in adults, a great propensity to sweat; a pain at the pit of the stomach, if it be pressed with the hand; a dulness and drowsiness, and sometimes epileptic fits, especially in children; and if the breeding of teeth is over, it is a sign the small-pox is at hand; for if the fit happens over night, the small pox will appear in the morning, and are, generally speaking, of the favourable sort.

On the fourth day from the beginning they break out, sometimes later, seldom before, at which time the symptoms either abate or wholly disappear.

The spots at first are reddish, and spread themselves over the face, neck, breast, and the whole body. Then there is a pain in the fauces, which increases as the pustules grow turgid.

On the eighth day the spaces between the pustules, which hitherto were white, begin to grow red and swell, and to be affected with a tensive pain. The eye lids are puff'd up, and close the eyes; next to the face, the hands begin to swell, and the fingers are distended; the pustules of the face, before smooth and red, begin to be rough, (the first sign of maturation,) and whitish, and throw out a yellowish matter, in colour like a honey-comb.

The inflammation of the face and hands being now at the height, the interstices between the pustules are of the colour of damask roses; and the more mild the disease is, the greater is the likeness.

The pustules about the face, as they ripen, grow more rough and yellow. But on the hands and the other parts of the body, they grow whiter and less rough.

On the eleventh day the swelling of the face and inflammation disappear; and the pustules being ripe, and of the size of a large pea, grow dry, and fall off.

On the fourteenth or fifteenth day they vanish entirely; except some obstinate pustules on the hands, which continue a day or two longer, and then break. The rest come off in branny scales, and in the face leave pits behind them.

Through the whole course of this disease the patient's body is either wholly bound, or he goes to stool but very seldom. Generally those who die of the small-pox, die on the eighth day in the distinct, and on the eleventh in the confluent sort. Then the face, which ought to be turgid, and the interstices florid, on the contrary is flaccid and whitish, at the same time that the pustules are red and elevated, even after the death of the patient. The sweat, which was injudiciously promoted by cordials and a hot regimen, suddenly ceases; in the mean while the patient is seized with a phrensy, a violent anxiety, a tossing and sickness; he makes water often and little, and a few hours close the tragical scene.

In the confluent sort there are the same symptoms, but much more violent. The fever, anxiety, sickness, vomiting, &c. more cruelly torment the patient; yet he does not so soon fall into a sweat, as in the distinct kind. A looseness sometimes precedes the eruption, and continues a day or two after it.

On the third day, sometimes before, seldom later, the spots appear; and the sooner, the more will they run together. Sometimes the eruption is retarded till the fourth or fifth day, by some terrible symptom; such as, a most acute pain in the loins, like a fit of the gravel; in the side, like a pleurisy; in the joints, like the rheumatism; in the stomach, with a sickness and vomiting.

But the symptoms do not remit after the eruption, as in the distinct sort; but the fever and other complaints continue to molest the patient many days after. Sometimes the spots appear like an erysipelas, sometimes like the measles, but are distinguished from them by the time of the eruption. As the disease increases, they do not rise to any considerable height, being entangled with each other in the face; but appear like a red blister, and cover all the countenance, which swells sooner than in the distinct kind. Afterwards they seem not unlike a white pellicle glued to the face, and are not much higher than its surface.

The eighth day being past, the white pellicle grows daily more rough, and of a dusky colour. The pain of the skin becomes more intense, and at last, in the more cruel kind of this disease, they do not fall off in broad large scales, till after the twentieth day. But this in the mean time is worthy of observation, that the more the ripening pustules are of a brownish colour, they are the worse, and the longer in falling off; and the more yellow

they are, the less they run together, and the sooner they disappear.

When the pellicle falls off, there is no roughness on the face, but branny scales soon appear in its room, of a very corrosive nature, which leave deep pits behind them, and sometimes ugly scars; sometimes the shoulders and back are quite deprived of their cuticle.

The danger of the disease is to be estimated from the number and multitude of the pustules on the face alone. The pustules of the hands and feet are the greatest; and the farther they are removed from the extremities, the less they are; in adults a salivation, and in children a diarrhoea, is a sign, though not always, of the confluent sort. The spitting sometimes begins with the eruption, sometimes two or three days after it; the matter is at first thin, but on the eleventh day it is viscid, and hawked up with difficulty; the patient is thirsty and hoarse, extremely sleepy, and his senses exceeding dull; he sometimes coughs when he is drinking, and the liquor regurgitates through his nostrils: then the salivation generally ceases, but the swelling of the face ought not to go down quite till a day or two after, when the spitting is over; if the hands do not begin to swell remarkably, and continue so for some time, the patient will suddenly leave the world.

The diarrhoea does not so soon attack children as the salivation does men. In both sorts of this disease the fever predominates from the first onset till the eruption; then it abates till the pustules are ripe, at which time it terminates.

The day on which the patient is most in danger, in the least crude and most common sort of the confluent, is the eleventh from the first attack of the disease; in the more crude, the fourteenth; and in the most crude, the seventeenth: sometimes, but very seldom, the patient does not die till the twenty-first. But in the space of time from the eleventh to the seventeenth, as the evening comes on, the patient is daily tormented with a fit of inquietude.

In the management of the patient in the distinct sort, regard should be had to the season of the year, and the strength of the patient. Let this be a general rule, to keep the patient in bed during the first days of the distemper, taking care to defend him from the inclemency of the winter by proper means; and to moderate the excessive heat in summer by cool air. For the patient ought not to be stifled by heat and cloaths, nor should the eruption and perspiration be checked by cold. However, great care ought to be taken in general to supply him with pure and cool air; because a hot air causes difficulty of breathing, checks the secretion of urine, and increases the number of pustules on the internal organs of the body.

With regard to DIET, it ought to be very slender, moistening, and cooling; such as oatmeal or barley-gruel; and in the beginning, the best regimen is that which keeps the body open, and promotes urine. This end is obtained by boiling preserved fruits with their food, such as figs, Damascene plums, and tamarinds; and by giving them subacid liquors for drink; as small-beer acidulated with orange or lemon juice; whey turned with apples, boiled

boiled in milk; emulsions made with barley-water and almonds; Mofelle, or Rhenish wine plentifully diluted with water; or any other things of this kind.

In the cure, Sydenham directs bleeding on any of the three first days to nine or ten ounces; and then an ounce, or an ounce and a half of emetic wine. But some physicians will not allow a vomit by any means, unless there is a nausea, and the head is much affected. Yet Hoffman judges it to be proper on the first day of the invasion, and prescribes two grains of emetic tartar dissolved in cinnamon water, to adults.

In youths and adults, it is often necessary to take away blood two or three times, only with an intermission of two or three days between each time. Blood-letting is so far from being an obstacle to the eruption of the pustules, if the patient is not too weak, that it forwards it considerably.

After BLEEDING, a vomit should be given, if the stomach abounds with phlegm or bile, or be loaded with food unseasonably taken. Otherwise a purge may be prescribed before the eruption of the pustules: which may be the infusion of fena with manna, or manna alone, especially for children; for no disturbance is to be raised in the body.

To keep the inflammation of the blood within due bounds, and to assist the expulsion of the morbid matter through the skin,

Take half an ounce of bezoar in powder, 2 drams of purified nitre. Mix, and beat into a powder.

Half a dram of this may be taken by an adult three or four times in a day; diminishing the quantity for children in proportion to their age.

Sometimes equal parts of these ingredients may be prescribed; and if the effervescence of the fever runs very high, a proper quantity of the spirit of vitriol may be added to the patient's drink. But if there be any reachings to vomit, they will be removed by draughts containing half an ounce of the juice of lemons, with one scruple of the salt of wormwood.

When the eruption of the pustules is completed, which generally happens on the sixth day from the attack, let the patient take an ounce of diacodium every evening till the tenth day after the invasion. On that night, if the small-pox be of the confluent kind, the dose must be increased to an ounce and a half; and an ounce in the morning; and so an ounce and half every night till the patient is recovered.

Whatever are the sort, and at whatever time of the disease a phrensy shall happen, it is to be curbed by pargorics, given one after another till the end is obtained, only waiting to see the effect of one dose before another is ordered.

In the mean time, if the patient is costive, which is generally the case, and the fever continues, the body is to be opened with a clyster every second or third day.

If the method is proper in the distinct small-pox, it will be found more necessary in the confluent, which is attended with greater fear and danger.

In every sort of this disease, it is proper to open the body on the decline, that is, on the ninth or tenth day from the eruption, because a putrid fever generally comes

on about that time, while the pustules are drying, or upon the subsidence of the swelling of the inflamed skin, where there is no suppuration, which fever cannot be taken off with equal safety by any other means; but gentle cathartics alone are to be employed in this case, such as were directed before the eruption of the pustules.

It will also be of use at this time to take away some blood, if the heat be too great, and the patient have strength to bear it.

This putrid fever is by Sydenham called the secondary fever, which comes on with heat, inquietude, tossing, &c. and, unless prevented, takes off the patient in two or three days. He mentions this fever as coming on the eleventh day, or later; but this is to be understood from the time of the invasion, whereas Mead reckons from the time of the eruption. Sydenham prescribes large bleeding, and a cathartic two days after, viz. one ounce of lenitive electuary dissolved in 4 ounces of simple alexeterial water, together with the free use of pargorics.

If the spittle through heat is so tough that it cannot be hawked up, let a gargle be frequently injected into the throat with a syringe. It may be compounded of barley-water and honey of roses.

When the matter of salivation grows very viscid, and begins to clog the larynx and trachea, the best method is to boil marsh mallows, myrrh, and honey, in a sufficient quantity of water and vinegar, and to transmit the steam of the decoction into the patient's mouth, thro' a glass or tin tube, of such a shape and length as is most commodious for a recumbent posture.

From the eighth day to the end of the disease, garlic may be applied to the soles of the feet; which must be renewed every day, especially when the brain is affected.

When the pustules are perfectly dry and withered, the face may be anointed with a liniment, made of equal parts of oil of sweet almonds and pomatum, for two days and no longer.

Twenty one days after the invasion, let a vein be opened in the arm, and the next day give a cathartic, which may be repeated every other day three times more.

This is necessary, because no species of fever requires the body to be thoroughly cleared of the remains of the disease more than this. After the cathartics, the body is to be restored to its former state by a course of milk, especially that of asses, with suitable food, and the air and amusements of the country.

As there are particular accidents in the small-pox which do not commonly occur, it will be proper to say something of them. Sometimes the patient is seized with convulsions just before the eruption, which is rather a good than a bad sign in children. In this case, blood-letting is carefully to be avoided; but a blister is to be applied to the neck, and to the soles of the feet. Plaisters made of equal parts of the cephalic and blistering plaisters; not forgetting to give antispasmodic medicines inwardly. The chief are wild Valerian-root, Russian castor, and the spirits of volatile salts chemically extracted from animals.

In adults, the thing is otherwise; for they, if not too weak, may lose a moderate quantity of blood, and then be put into the foregoing method.

Haller tells us, that camphire assists greatly in filling the small pox of the confluent kind with petechiæ; and Monro, that the Peruvian-bark does the same, that it filled the empty vesicles with matter, changed the watery sanies into thick white pus, made the petechiæ or spots turn gradually to a pale colour, and caused the pox to blacken sooner than was expected. The dose in powder, is from ten to twenty grains, in some rich syrup, with an aromatic distilled water, every four or five hours. Children may take it in a clyster, with a small quantity of warm milk, after the bowels are unloaded with a preparatory clyster. If the clyster was retained too short a time, syrup of poppies was added, or diafcardium. These injections were repeated morning or evening or oftner. The bark has had good effects in mitigating the secondary fever. When the lungs are greatly stuffed, it is not to be given.

When the eruption appears without much fear or pain, it is not without danger; for the pustules frequently do not tend to maturity, and there is no suppuration made. Hence the fever increases, with inquietude of body, anxiety of mind, difficulty of breathing, and a delirium, which carry off the patient in a few days. In this state, the fever ought rather to be raised than checked; and then warm medicines are to be directed which promote suppuration, by increasing the motion of the blood, and thinning the humours, such as Virginia snake-root, contrayerva-root, saffron, *assa-fœtida*, myrrh, and the like.

But above all, **BLISTERS** must be laid on the limbs.

When the matter of the infection is over abundant, as it happens in bad cases, nature never fails endeavouring to throw off the load. Thus in adults a spitting comes on upon the first days of the eruption; whereas children have a looseness almost through the whole disease, which is not to be inconsiderately stopped. So in adults, if the spitting does not go on to our wishes, it ought to be promoted by medicines which stimulate the glands of the mouth, especially gargles made of a decoction of mustard-seed and pepper, with the addition of oxymel. For in the confluent and malignant small-pox, if this flux does not arise and continue to the end of the disease, it is a very bad sign.

The method of abating the rigour of this disease, and preventing the great mortality with which it was often attended, by inoculation, is now so well known and so generally practised, that a particular detail of it in this place is unnecessary.

#### *Of the ERYSIPELAS, or St ANTHONY'S FIRE.*

AN ERYSIPELAS is an eruptive fever, from which no part of the body is exempt; but it chiefly attacks the face. It begins with chills and shivering, and other common symptoms of a fever. The part affected swells a little, with great pain, and intense redness, and is beset with a vast number of little pustules; which when the inflammation is increased, are converted into small blisters.

This disease has great affinity with a pestilential fever; for it begins suddenly, with great shaking, heat, loss of strength, violent pain in the back and head; to which may be added vomiting, and a delirium; but this is to be understood of the worst sort. On the third or fourth day the malignant matter is thrown out on the surface of

the body, and then the symptoms a little abate. There is often a pain, redness, and tumour in the inguinal glands, from whence matter of a hot fiery quality descends to the feet. If the head is attacked, the parotid glands are affected; if the breasts, the axillary. The mammary and axillary glands are not seldom ulcerated, and affect the joints with a virulent corruption. And likewise, as in the plague, there is nothing more dangerous than the return of the expelled matter back from the surface of the body to the inward parts.

In some, especially young persons, the matter is not so virulent, nor the fever so great; the glands remain unaffected, and the eruption happens on the second day. This is not at all dangerous.

An erysipelas is either true, or simple and spurious, which is likewise called scorbutic. The simple only affects the surface of the skin, and readily yields to proper remedies. But the spurious is more chronic, is harder to cure, and often degenerates into malignant ulcers. Besides, this disease is sometimes idiopathic, or a primary disease; and sometimes symptomatic, or a secondary one. For instance, in the anasarca, the ascites, the yellow and black jaundice, a symptomatic erysipelas sometimes supervenes, and quickly kills the patient.

If it seizes the FOOT, the parts contiguous will shine; if it be attended with great pain, it will ascend to the legs, and will not bear to be touched.

If it attacks the FACE, it swells and looks red, and there are plenty of watery vesicles. The eyes are closed up with the swelling; there is a difficulty of breathing; the fauces and nostrils are very dry, often attended with a numbness and drowsiness: hence an inflammation of the brain is to be feared, or a mortal lethargy.

If it affects the BREASTS, they swell, and grow almost as hard as a stone, with exquisite pain, and they are very apt to suppurate. There is a most violent pain in the axillary glands, in which an abscess is often formed.

In children the umbilical region generally suffers, with a fatal event.

If in a day or two the tumour subsides, the heat and pain cease, the rosy colour turns yellow, the cuticle breaks and falls off in scales, the danger is over. When the erysipelas is large, deep, and falls upon a part of exquisite sense, the patient is not very safe. But if the red colour changes into black and blue, it will end in a mortification. If the inflammation cannot be dissipated, it will suppurate, and bring on fistulas and a gangrene. When the patient is cacochymic, the leg will sometimes swell three times as big as the natural size, and is cured with great difficulty. Those who die of this disease, die of the fever, which is generally attended with difficulty of breathing, sometimes a delirium, sometimes with sleepiness; and this in seven days time.

Let the patient's diet be only water-gruel, or barley-broth, with roasted apples. If he drinks any beer, let it be very small; and let him keep out of bed some hours in a day.

Take away 9 or 10 ounces of blood, and the next morning let the patient take the common purging potion.

It is a constant rule among practitioners, in all acute and eruptive fevers, to keep the body in a gentle diaphoresis.

refis. The same method is to be observed in this disease.

If the patient is plethoric, addicted to spirituous liquors, and more especially if the disease attack the head, bleeding is necessary.

It will be safest to avoid external applications, unless a powder made of elder-flowers and liquorice sprinkled on the part; or lime water, mixt with a fourth part of spirit of wine and camphire, dipping a linen cloth in it several times doubled, and applying it hot to the part.

An infusion of scordium, elder-flowers, and fennel-seed, drank in the manner of tea, is useful to expel the morbid matter.

If the disease does not yield to the first bleeding, let it be repeated: if that will not do, let it be reiterated twice more; one day being interposed between.

On the days free from bleeding, prescribe a clyster of milk and syrup of violets.

Some think purges not necessary in the beginning of this disease; but in an erysipelas of the head, when it affects the brain with a coma and a delirium, either the case is desperate, or cathartics will succeed. However, first apply blisters to the neck.

If, after all, the tumor remains, and begins to turn livid; if the pin lies deep, and seems to reach the periosteum, and the part has a tendency to ulcerate; then it will be proper to promote a suppuration; at the same time endeavouring to stop the progress of the putrefaction. For this purpose the common plaster will be proper, with a sufficient quantity of camphire and saffron. When there is matter that lies deep, the tumour is to be opened with a lancet, and the pus is to be got out by degrees, not all together.

When the abscess is in a glandulous part, and has degenerated into a fistulous ulcer, after evacuating the matter, a balsamic liquor is to be injected, made of tincture of St. John's wort, tincture of balsam of peru, choice myrrh, and a few drops of the spirit of turpentine.

When there is a mortification coming on, give things inwardly that resist putrefaction, as nitre and a little camphire, [or rather the Peruvian bark.] Outwardly apply a mixture of lime-water, camphorated spirit of wine and vinegar with litharge; as also tincture of myrrh, [or of myrrh and aloes] made pretty hot, with a linen cloth doubled, and often repeated.

In the scorbutic erysipelas, which continues for some time, it will be proper to give gentle laxatives and purifiers of the blood, with diaphoretics. After the body has been opened for some days, give diuretics and diaphoretics alternately for a considerable time; and for common drink, order a temperate decoction of mucilaginous woods and roots with bitters; particularly succory roots, dandelion-roots, and raisins.

*Of the SYNCHUS, or Continual FEVER without remission.*

THIS fever, by some called *SYNOCHA*, by others a *CONTINUAL FEVER*, is an acute sanguineous fever, because it is raised by a congestion of the blood, chiefly in the nervo-membranous parts; which, unless timely dissipated by the benefit of nature and art, produces a fatal inflammation.

It begins, in some, with a mild sense of cold, and is soon attended with very grievous symptoms, continuing without remission till the critical time, with a great and full pulse. If the blood is forced to the head, for it always affects one part more than another, the face will swell, the eyes will be red and full of tears; there is a pain in the head, with a pulsation of the temporal arteries, a vertigo, a sleepiness, torpor, or a raving. When the blood rushes impetuously into the ventricles of the heart and pulmonary vessels, causing a distention therein; then the breathing will be thick and difficult, with a straitness of the breast, as also an anxiety and palpitation of the heart, attended with a loss of strength, and a dejection of the mind. A slight inflammation of the œsophagus, with a spastic stricture of the glands of the fauces, will cause thirst, dryness and blackness of the tongue. If the inflammatory congestion happens in the stomach, it will create a nausea, a reaching to vomit, and sometimes a hiccup. If in the intestines, there will be inflations grievously exasperating the disease, together with a costiveness, or an ejection of fetid excrements. If in the vessels proceeding from the mesaric arteries and vena portæ, there will be a fixed pain at the first vertebra of the loins: if in the membranes of the spinal marrow, the patient will tumble and toss and lie irregularly in bed, and will have a torpor and languor of the limbs, sometimes attended with convulsions.

But all these symptoms never happen to all, nor is their violence constantly alike. Some distinguish this fever into the simple and putrid. The first is caused by a congestion of good blood in improper places. But when it attacks persons full of impure juices, who have been weakened by a preceding disease, constant anguish of the mind, excessive coition, or inordinate living, the symptoms are much more grievous, with loss of strength, and the disease will continue till the fourteenth or the twenty-first day, sometimes with eruptions, dusky or black spots, with immediate danger.

If the cause is not violent, this disease will often disappear, merely by the benefit of nature, on the fourth, seventh, or eleventh days, with a large sweat or bleeding at the nose, and, though very seldom, by a flux of the belly, unless it has something of malignity.

When the disease is rightly managed in the beginning, that is on the first, second, and third day, with bleeding and cooling things, and gentle diaphoretics, it will end on the fourth. But if the bleeding is omitted, or is too little, it may continue till the fourteenth or seventeenth day, with the more grievous symptoms, as also a delirium: but it will terminate at last by a sweat or looseness.

When it proves fatal, the patient generally dies of a sphacelous inflammation of the brain, or other parts, as the stomach or intestines.

The intentions of cure are, 1. To free the vital parts from too great a congestion of blood, which will either disperse a slight inflammation, or prevent a great one. 2. To appease the exaltation of the blood and the spastic affection of the system of the nerves. 3. To discuss the stagnating and corrupted fluids, and to restore a free circulation of the blood, chiefly to the surface of the body.

To answer the first intention, the patient must lose

blood.

blood freely. Then the organ of the blood must be appeased with diluents, acids, and nitrous compositions. And certainly if any disease requires acids, and the juice of tart fruits, it is this, such as tamarinds, and the juices of currants, oranges, and lemons.

Take two pounds of water; rose-water, white sugar, and juice of oranges, of each one ounce.

The jelly of hartshorn made pretty thin, with the addition of orange-juice, sugar, and rose-water, will make a proper demulcent and cooling drink; or whey turned with juice of lemons or oranges.

To direct the motion of the blood to the surface of the body, gentle diaphoretics will be proper, such as the bezoardic or absorbent powders, sometimes alone, and sometimes with citron juice. Likewise infusions of the leaves of *veronica*, *scordium*, or *carduus benedictus*, with fennel-seed, drank in the manner of tea, especially to promote sweating on the fourth day, when the disease is like to terminate with this salutary excretion.

It will be necessary, whether this fever be simple or putrid, to keep the body open; for which purpose a clyster made of whey, honey, oil of sweet almonds, with a little nitre and salt, will be proper; for by this means the stricture of the intestinal fibres will be relaxed, and flatus's will be discharged, which distend the colon. In the decline of the disease, when there are apparent signs of coction in the urine, a laxative of manna and cream of tartar, or cassia and rhubarb, will be of great use.

#### Of the BILIOUS FEVER.

THE bilious is a kind of a burning fever. It begins with intense heat, thirst, anguish, and inquietude. There is likewise a vomiting, or a perpetual reaching to vomit, with frequent bilious stools, a coldness of the extremities, intermal heat, and cardialgic anxiety. This fever is either acute, or very acute. In this the symptoms are more violent, the bilious purging upwards and downwards is very plentiful, joined to a *cardialgia* with fainting. It generally kills before the seventh day, with an inflammation of the stomach and duodenum; the signs of which are, a fixed igneous heat about the *præcordia*, with a coldness of the extremities, high inquietude and anxiety, a hiccup, and a plentiful eructation of bile and salivary liquor, a jaundice-colour of the countenance, and a hippocratic face.

Some are not so acute, but run a greater length, with now and then a remission, and perhaps an intermission, and have an exacerbation, with vomiting, anxiety, and coldness every other day, or every third day, and ought to be called continual quotidians or tertians.

It is caused by a bilious fluid secreted plentifully in the liver, and poured out into the stomach and duodenum, where by its acrimony and corrosiveness it stimulates the nervous tonics, corroding and inflaming them; whence the symptoms proper to this fever arise, such as a burning heat, a cardialgic anxiety, a nausea, a reaching to vomit, and a violent purging upwards and downwards.

Hoffman, in the cure of the bilious fevers mentioned by him, would have the caustic acrimony of the bilious juices abated and sheathed by absorbent powders and nitre, which should be taken in a sufficient quantity of a liquid,

and often repeated. He likewise recommends emulsions of almonds, of the cold feeds; yelder flower water, rose-water, &c. as also jellies of hartshorn, milk and water, oil of sweet almonds, sweet whey, chicken broth.

After these things, medicines must be given to restrain the impetuous bilious excretions, and to abate the too quick systaltic and peristaltic motion of the biliary ducts, and to prevent the too great excretion of the bile.

In the cure of the BILIOUS FEVER of the camp, Pringle, before it becomes continual, depends on the proper use of evacuations, the neutral salts, and the bark. BLEEDING is the first thing to be done in every case, and is to be repeated once or oftener, according to the urgency of the distemper. The vernal and later autumnal remittents are accompanied with rheumatic, pleuritic pains, and other symptoms of high inflammation, which require more bleedings than the intermediate season. To omit this, and give the bark too soon, will bring on an inflammatory fever. A vein may be opened safely either during the remission, or in the height of the paroxysm.

After bleeding, give an emetic in the remission or intermission of the fever, and rather soon after a paroxysm than before one. But emetics do harm when the stomach is inflamed, or when the disease has continued some time, and has assumed the type of a continual fever. However, we may safely give one when the fever intermits, or has considerable remissions. Ipecacuanha is safest, but antimonials most efficacious. If the remissions are small, or the fever great, or there is a tendency to vomit, the former is best. But when the remissions are distinct, or the remission perfect, the latter should be preferred; or it may be joined to the former; that is, two grains of tartar emetic, with a scruple of the powder of ipecacuanha. Those vomits are best which produce stools, especially if they procure a plentiful discharge of corrupted bile upwards or downwards.

If the body continues costive, a laxative will be proper, especially if there is a tenesmus, or pains in the bowels. The saline draught, with salt of wormwood and lemon-juice, will bring the fever sooner to regular intermissions.

Whenever the sweats are not profuse enough in proportion to the fits, the quantity of an ounce of *spir. Mindereri* may be given, divided into two or three draughts, before they go off. It promotes a plentiful diaphoresis, without heating.

As the fevers are never without an inflammation in the beginning, and then rarely have complete paroxysms, the bark is not to be given till the urine breaks, and there are entire short intermissions; nor yet before bleeding, as was observed above; nor before the first passages have been cleaned; otherwise the fever will return, or a tympanites will be produced.

It is best to give the bark in substance in Rhenish wine; or an ounce of it may be made into an electuary, with syrup of lemons, and a dram of sal ammoniacum. If the patient has not been purged, it will be proper to add as much rhubarb as will keep the body open for the first two or three days of using that medicine. It is chiefly useful when the bilious humours abound, as they mostly do in marshy countries. If the paroxysms are quotidian, and  
the

the intermissions short, it may be necessary to give the bark before the sweating is quite over.

If the disease has been neglected in the first stages, or if after the remissions or intermissions it changes to a continual fever, with a full and hard pulse, a vein must be opened. But if there is a pain in the head, or a delirium, and the pulse small, it will be best to apply leeches to the temples. But whether the patient is bled or not, blisters are the best remedy. If the *primæ viæ* are loaded, clysters or a laxative may be proper; but neither vomits nor purges; nor are those to be repeated without caution. To these remedies the saline draught may be added.

Sweating is the proper crisis: it is never to be promoted by theriaca or volatiles; but when the pulse sinks, and petechiæ, or other symptoms appear, it will be proper to use the warmer alexipharmics, and to treat the disease like a malignant fever.

A looseness is the least favourable crisis: yet if there are colic pains, or a tension of the belly, attended with dryness of the skin, it will be proper to procure stools by a clyster, or a gentle laxative, such as the infusion of rhubarb with manna; which is to be repeated as the patient can bear it.

#### Of a CAUSUS, or BURNING FEVER.

THE principal symptoms of a causus are, a heat almost burning to the touch, most remarkable about the vital parts, but more moderate towards the extremities, which are even sometimes cold: the breath is extremely hot; there is a dryness of the whole skin, nostrils, mouth, and tongue. The respiration is thick, difficult, and quick; the tongue is dry, yellow, black, parched, and rough; the thirst is unquenchable; there is loathing of food, a nausea and vomiting; an anxiety, inquietude, and great lassitude; a little cough, a shrill voice, a delirium, a phrensy, a continual watching or a coma, convulsions, and on the odd days an exacerbation of the fever.

In this temperate climate these sort of fevers are very rare; those that are more common among us are the burning sanguineous, or the continual bilious fevers without remission.

This begins without any remarkable coldness or shivering, with great heat, thirst, watching, anxiety and inquietude. In sanguineo-bilious constitutions, and in bodies full of hot bilious blood, they terminate in critical days in health or death, being first preceded with a shaking. They terminate in a salutary manner, with a sweat or a bleeding at the nose.

On the third and fourth day it often proves mortal; it seldom exceeds the seventh, if violent.

It is often terminated by an hæmorrhage; which if small on the third and fourth day, it is a fatal sign. It is best if it happens on a critical day.

A solution of this fever on a critical day, may also be by vomiting, stool, sweat, urine, or spitting thick phlegm. If the exacerbation of this disease happens on the second or fourth day, it is a bad sign; on the sixth, not so bad.

The urine black, small in quantity, and thin, is fatal; so is spitting or pissing of blood. A difficulty of swal-

lowing is a bad sign; but the worst of all is coldness of the extreme parts. The face red and sweaty, is bad; a parotis not tending to suppuration is fatal; the body too loose is fatal. A tremor turning into a delirium is mortal: it often changes into a peripneumony with a delirium. When this disease succeeds gripings of the bowels, it is worst of all.

A critical determination of this fever is usually preceded by a rigor, or shaking.

THE CURE of a burning fever is most easily obtained in a pure, cool air, frequently renewed: The patient must not be oppressed or stifled with bed-cloaths, but should sit up often. He should drink plentifully of soft, sub acid, aqueous, and warm liquors. His diet should be light, made of pearl barley, oatmeal, and sub-acid fruits.

Bleeding is necessary at the beginning, if there is a plethora, or signs of a particular inflammation, or the heat is intolerable, or the rarefaction too great, or a revulsion necessary, or the symptoms urgent, in which circumstances the disorder is hardly to be vanquished by any other remedies.

Soft, diluting, laxative, antiphlogistic cooling clysters, are to be repeated as oft as the heat, costiveness, and revulsion require them.

The whole body is to be moistened by receiving into the nostrils the steams of warm water; by washing the mouth, throat, feet, and hands, with the same; by fomenting with warm sponges the places where the vessels are most numerous, and most exposed to the touch.

The medicines should be aqueous, soft, nitrous, gratefully acid, gently laxative, not promoting sweat and urine by their acrimony, but by their plenty; such as remove the contraction of the fibres, resolve the thickness of the humours and dilute, and temper their acrimony.

To appease thirst in this disease, and to moisten the tongue and parched fauces, there is nothing better than sweet whey, in a quart of which half a dram of pure nitre has been dissolved. Small draughts of this, a little cool, may be drank frequently, which will likewise extinguish the pernicious heat. The mouth and throat may also be washed with water, mixt with syrup of mulberries and nitre.

Purgatives are dangerous before the crisis, but clysters may be used, made of milk, honey, and a little nitre. After the crisis, which is known by the sediment in the urine, laxatives made with tamarinds, manna, rhubarb, raisins, or cream of tartar, are absolutely necessary.

#### Of the Burning Bilious FEVER, or YELLOW FEVER of the West Indies.

THE yellow fever begins with a momentary chillness and shivering, which is soon succeeded by a burning heat all over the body, but is felt more intensely about the præcordia. The pulse is high, strong, and rapid; the eyes are heavy; with a throbbing pain in the head, and a violent beating of the temporal arteries, and a thick, laborious respiration: There is a nauseafulness, and reaching to vomit; and when any thing is thrown up, it is of the bilious kind: Besides these, great anxiety, pain in the back and loins, and an uneasy lassitude in all the limbs.

About

About twelve hours after the invasion, the tongue is dry, harsh, rough, and discoloured, with insatiable thirst; there is a soreness all over the body, great restlessness, and a delirium.

In the last stage the patient labours under a great coma, oppression of the præcordia, heaving of the lungs, an interrupted respiration, tremblings of the tendons, convulsions, and cold clammy sweats.

It usually terminates in a favourable crisis, or the death of the patient, about the fourth day after the attack.

The regular crisis generally discovers itself by a suffusion of the bile all over the surface of the body about the third day. The saffron tincture is frequently discovered in the eyes twelve hours after the invasion: the sooner it appears, the more favourable is the prognostick.

If the jaundice comes on too soon, it is bad; if with livid spots, which sometimes, though rarely, appear, it is fatal. If the skin continues obstinately dry and rough, the case is dangerous; and the more so, the longer it continues; for these very seldom recover, be the pulse ever so good. The pulse is not to be depended on; for many have a good pulse a few hours before death. If the vomitings are incessant, grow darker, and the hiccup comes on, it is generally fatal. If the face is greatly flushed, and the vessels of the white of the eye are turgid with blood, as in an ophthalmia attended with a phrenzy, the patient is likely to die in a very little time, especially if the skin is dry.

But if the head continues clear, the pulse becomes soft, the pains, nausea, and anguish are relieved by bleeding; as also if the humours vomited up are carried downwards by laxatives; if then the inquietude ceases, the skin grows soft and moist, and the patient has better spirits; it is probable he will recover.

Bleeding is the first thing to be done, more or less, according to the force of the disease and the strength of the patient; and, if the symptoms continue in their full vigour, should be repeated once in six or eight hours, lessening the quantity proportionably each time.

After the first bleeding, give a vomit of ipecacuanha, quickened with three or four grains of emetic tartar, (or rather two grains,) which will bring up a great quantity of yellow, porraceous, and sometimes blackish bile, and carry the humours downwards.

After this the patient may drink plentifully of diluting, refrigerating, and subacid liquors, made with oranges, lemons, tamarinds, spirit of sulphur, spirit of vitriol, and such like, in barley-water, spring water, or other thin and cooling vehicles. He may likewise be allowed tartish juicy fruits; as ananas, granadilloes, Barbadoes cherries, and water-melons; as also plantains, and bananaes, roasted for food, jelly of guavaes, &c.

Cooling testaceous powders are likewise very beneficial.

Towards the evening it will be necessary to inject a clyster, made of the common decoction, with half an ounce of cream of tartar, an ounce of manna, or an ounce of pulp of cassia added to it.

When the operation of the clyster is over, paregorics will be proper, as thus:

Take 2 ounces of mint-water, one ounce of cinnamon

water, 25 drops of the tinctura thebaica, and a sufficient quantity of sugar.

The room should be kept cool, and sprinkled with vinegar, rose-water, and cooling herbs. Fresh air should be admitted, but not to blow directly on the patient's body.

Blisters are also of great efficacy at this juncture; which if applied before it be too late, a coma, the deadly symptom of this distemper, very rarely ensues.

The patient's diet should be nothing but thin panada and water-gruel, gratefully sweetened and acidulated.

Besides plentiful and frequent draughts of cooling liquor, the patient should be allowed preserved tamarinds, slices of lemon with a little sugar; but above all, penguins, which by their sharpness penetrate the thick tenacious scurf, whereby the glands of the mouth will be unloaded. Opiates must also be used in larger doses than in Europe.

Cooling and lenient clysters must also be repeated every eight hours.

When the patient begins to be comatose, the third and last stage of the disease is advancing; in which are, difficulty of breathing, oppression of the præcordia, convulsive twitching of the tendons, interruption of the pulse, and at length its total cessation.

In this case, a complete set of blisters must be immediately applied, or the old ones renewed; which must be laid to the nape of the neck, on the wrists, thighs, and legs, and a large one on the crown of the head. To the soles of the feet may be laid a cataplasm of salt-herrings and mustard.

With regard to the urgent symptoms; pains of the head, watchfulness, and deliria, are to be relieved by emollient and laxative clysters, gentle purgatives, cupping with scarification, opening the frontal vein, lotions of the feet, and narcotics.

Blisters are also useful for the same purpose.

Convulsions require much the same treatment externally; and internally, *aurum musivum*, (the dose from four grains to a scruple.) To restore the strength of the patient, little more is required than a stomach-purge or two, mild and agreeable bitters, and a restorative regimen of broths, jellies, and white meats.

If the yellow tincture remains upon the skin, give a vomit of ipecac. and a purge or two with the decoction of fenna, tamarinds, &c. and allow the use of lemons, oranges, and other acid fruits. If this disorder proves obstinate, treat it as the jaundice.

#### *Of the SENEGAL FEVER.*

THE fever which chiefly prevails in this country in the months of July, August, and September, is of the worst kind. It usually begins with drowsiness, lassitude, and great rigors, which continue frequently three or four hours, and are succeeded by intense heat and sweats. For three or four days it remits, and both the shiverings and hot fits become more moderate. During this period, the pulse is quick and low; but afterwards becomes fuller, unless some evacuation intervene. At this time profuse sweats are easily brought on; in which case there are little hopes of recovery. A parched, dry skin, is as bad a symptom, if it continues more than a day; for an intermitting

intermitting pulse and a delirium succeed, and continue for seven or eight days, the frequency of the intermissions increasing every day: but if a general moderate moisture comes one at this, or any other time of the disorder, and continues, the patient recovers. A violent pain in the head and back, and difficulty of breathing, are general complaints. Sudden languors, and bilious vomitings, are frequent through a great part of the time.

Some are taken with a great heat, and a strong quick pulse, without any shiverings or remissions, as abovementioned. In this case the patient sooner dies upon the appearance of bad symptoms, and is longer in recovering upon the appearance of good ones.

The loss of eight or ten ounces of blood, in the first attack of these fevers, has sunk the pulse beyond a possibility of raising it afterwards, and that even in plethoric habits, attended with great pains of the head. It is, indeed, surprising how little these fevers will bear of evacuations of any kind, especially bleeding.

After profuse sweats, the pulse becomes extremely slow; and, though the sweating goes off, continues so for two or three days, with anxiety and restlessness; after which the pulse grows quick, the skin parched and hot, and a series of bad symptoms comes on.

The sick are always comatose and stupid; which symptom is little dangerous when attended with a warm moisture on the skin, but otherwise it is generally fatal.

It is of great consequence to keep up the pulse; but here the common cordial medicines are ineffectual; yet the decoction of the bark, with the camphorated julep, and spirit of vitriol, answers this purpose effectually, so as to render any other medicine unnecessary, except occasionally a gentle emetic or laxative.

#### *Of the INFLAMMATION of the STOMACH.*

THE inflammation of the stomach is known by a burning, fixed and pungent pain in the stomach, which is exasperated at the instant any thing is taken into it; and is succeeded by a most painful vomiting and hiccup. There is always a violent internal heat, high anxiety, and a grievous pain about the præcordia, chiefly at the pit of the stomach, an acute, continual fever, great thirst, difficult breathing, inquietude, tossing of the body, coldness of the extreme parts, a hard, contracted, quick, and sometimes unequal pulse.

It may be distinguished from other disorders of the stomach; for in the cardialgia, there is also a great anxiety about the præcordia, a pressing acute pain reaching to the back, a coldness of the extremities, a constant stimulus to vomiting, with inquietude: But the heat in the region of the stomach is not so violent, nor is the thirst and dryness of the tongue so great, nor the pulse so quick and contracted, and the stomach can better bear and retain any thing taken inwardly; nay, is frequently relieved thereby. An inflammation of the intestines has a pain or gripes more about the region of the navel, with frequent, frothy, bilious stools, or a little bloody, with a heat over all the surface of the body, and a quick large pulse: Whereas in this disease the extremities are cold.

If it be caused by drinking cold liquors when the body

is hot; or from an effusion of the bile after violent commotions of the mind; the danger is not very great, as there will be room for suitable medicines to take effect: But that which arises from drastic purges, sharp emetics, or caustic poisons, kills quickly without speedy assistance. This disease likewise often proves fatal to the old, the infirm, the scorbutic, and persons full of grief, as also in the end of acute diseases.

When there is a restless tossing of the body; when liquids are immediately thrown up; when there is a hiccup, a fainting, an hippocratic face, an intermitting pulse, and convulsions, a fatal mortification will soon terminate the patient's life.

This disease, if not suddenly cured, is generally mortal: And therefore, as soon as it is discovered, plentiful bleeding is necessary, and must be repeated as the violence of the symptoms increases. Let the drink be very soft, antiphlogistic, and emollient; as also clysters of the same kind.

The patient should totally abstain from every thing that is acrimonious; even the cooling, nitrous salts, which are beneficial in other inflammations, irritate too much. Vomits, cordials, and spirituous liquors, are little better than poison.

Aliments should be given frequently, and by a spoonful at a time; for any distention increases the inflammation. A thin gruel of barley, oatmeal, whey, with very little sugar or honey, or chicken-broth, are proper aliments; whey-emulsions, barley-water, emollient decoctions, are proper drinks.

The indications of cure are, 1. To open the obstructions caused by tenacious juices impacted into incongruous vessels; 2. To remove the spastic strictures which contract the vessels, and to restore the equable and natural progress of the blood through the substance of the stomach. These ends are to be obtained by *diluents, humectants, demulcents, antispasmodics*, and things that restrain the heat which thickens the fluids, and relax the contracted fibres.

But as there are more causes than one that produce an inflammation, they will require different remedies to bring about a cure.

Therefore, if it be owing to a caustic, septic, arsenical poison, or a strong emetic or cathartic, or to metallic medicines ill prepared, and thence the inflammation; oily fat things are proper, as new milk, cream, oil of sweet almonds, or olive-oil taken often and plentifully.

If from a spasm, succeeding a violent commotion of the mind, then a nitrous absorbent powder will be proper, in an emulsion of white poppy seeds. When the spasm is appeased, rhubarb with raisins will be necessary to carry off the bilious fordes.

When an eruptive matter is repelled and causes this disease, use emulsions of the greater cold seeds, with temperate bezoardic powder; now and then adding a little nitre and a small matter of camphire.

If from a caustic bile, as in the cholera morbus, an inflammation is apprehended, earthy absorbents and hartshorn philosophically prepared should be given, with gelatinous decoctions of calves and neats feet, or hartshorn-jellies.

jellies and water-gruel. Outwardly, the following liniment is useful in all cases :

Take of oil of sweet almonds 2 ounces, and a dram of camphor; mix and make them into a liniment, to be applied warm to the stomach.

*Of the QUINSEY.*

A QUINSEY is an inflammation of the fauces, with a burning pain, tumor and redness; a difficulty of breathing or swallowing; and a fever, proceeding from a stasis of blood, or a viscid acrid serum in the sanguineous or lymphatic vessels.

It begins with a fever, which is followed with a pain and inflammation of the fauces, causing the uvula, tonsils, and larynx to swell; whence great difficulty of breathing and swallowing ensues.

This disease may be seated at the root of the tongue near the *os hyoides*; the *foramina* of the nostrils opening to the bone; the beginning of the *œsophagus*; the muscles of the pharynx; the internal and external muscles of the larynx; the greater and lesser glands; the tonsils, or the muscles moving the jaws.

When a quinsy affects the internal muscles of the larynx, and there is no outward redness about any part of the neck, but a burning pain inwardly, a loss of voice, and great difficulty of breathing; it often kills in twenty-four hours. This is called a *kyranche*. When it is seated in the internal muscles of the pharynx, it is called a *synanche*; in which there is no external tumor and redness, but a great difficulty of swallowing and breathing, and whatever is drank returns through the nose. When there is an outward tumor and redness, and the external muscles of the pharynx are affected, it is a *parasyanche*; when the external muscles of the larynx, a *parakynanche*.

A quinsy is likewise distinguished into the true and spurious. The true arises from the stasis of the blood; the spurious or bastard from a congestion of the serum. The former is acute, always attended with a rigor and a fever. The latter has rather a lymphatic or catarrhal, than an acute fever. The first has not only a burning, pricking pain in the inner parts of the fauces, but the tongue is turgid with blood, and of a dark reddish colour; the face is likewise red; there is a great pulsation of the temporal arteries; sometimes a head-ach, a torpor of the senses; sometimes fainting.

When it is very violent, there is a difficulty of breathing, high anxiety, and coldness of the extremities; and is very dangerous, requiring speedy help. But in the spurious, those symptoms are either absent, or more mild; nor is the danger so great.

This disease may be caused by a suppression of some usual sanguineous evacuation; by admitting the cold air after a strong sudorific has been taken; and by lying in rooms new plastered or white-washed. Some caustic poisons affect the throat more than other parts. White hellebore attacks the fauces, and brings on a strangulation. The same ensues from the *solanum furiosum*, and the bite of a mad dog. The fumes of arsenical and mercurial minerals, as also the vapours of mineral spirits, will have the same effects.

It sometimes comes on spontaneously, and is again the symptom of another disease, as the diarrhoea and dysentery, especially if the flux is hastily stopped. It has happened from the striking in of an erysipelas; or sometimes from the gout being injudiciously treated with topicks; as also from the small pox, or a malignant or pestilential fever. The cause of the symptomatic disease is costiveness, or suppressed perspiration, or the striking in of eruptions. When it is epidemic, it has something of malignity.

When the swelling, pain, and redness, appear more outwardly, and vanish by degrees, it is a sign of a happy solution of the disease. But when the external swelling suddenly disappears, without a mitigation of the symptoms, it shews the morbid matter to be translated elsewhere, and will change to a phrenzy or peripneumony. Or this disease may terminate in a suppuration or gangrene, or a schirrus. A frothing at the mouth, the tongue vastly swelled, and of a purple, blackish colour, portend death.

In these inflammations a slight diarrhoea relieves: Therefore aliments which promote it are useful, as tamarinds infused in whey; decoctions of farinaceous vegetables moderately acidulated, and such as abound with a cooling nitrous salt, are proper. Burnet is said to be a specific in this case. Mulberries are beneficial, and all acids.

The mouth and throat must be kept moist, and the nose clear, that the air may have clear passage through it. When the patient cannot swallow, he may be nourished by clysters.

Take away blood plentifully from the arm, and afterwards open a sublingual vein; but bleeding in the jugular yields the best assistance, and is much more safe. If the symptoms continue to be very urgent, the bleeding may be repeated in six or eight hours time, till they begin to be more mild.

After the first bleeding, lay a strong and large blister on the fore-part of the neck, or a piece of flannel dipt in the volatile liniment.

Then let the parts inflamed be touched with the following mixture:

1. Take a sufficient quantity of honey of roses and spirit of sulphur. Mix them.

Then the following gargle is to be used, held in the mouth till it is hot before it be spit out; which is to be repeated pretty often:

2. Take a pound of barley-water, 8 ounces of honey, and 2 drams of spirit of sal armoniac. Mix them.

Emollient steams, or even the steam of hot water taken in at the mouth, are beneficial.

- If the patient is not able to swallow any nourishment,
3. Take ten ounces of beef-tea, 10 grains of nitre, and 6 drops of spirit of salt. Mix and make them into a clyster.

Let it be injected every eighth hour, after the belly has been cleansed with a purging clyster.

If the tumor tends to a suppuration, it is best promoted by holding fat, dried figs in the mouth; and when the tonsils are full of an inflammatory ichor, honey of roses mixt with spirit of vitriol, and often applied to the part with a pencil, is excellent.

That

That inflammatory pain which arises from a sharp salt serum in the glandulous parts of the fauces, with redness, and a copious flux of saliva, but without a fever, may be cured with a gargle of brandy alone. An inflammation of the fauces is sometimes cured with ten drops of camphorated spirit of wine, in which a grain of nitre has been dissolved, and suffered to pass slowly down the throat.

The acute and inflammatory quinsy may be defined, "An inflammation of some part or parts, either within or contiguous to the throat, rendering deglutition painful, or impracticable; and, when it is of the most dangerous kind, likewise affecting respiration."

When only swallowing is impaired, the parts inflamed may be the tonsils, the velum palati, and uvula, the muscles of the pharynx, and those of the larynx, which raise it or pull it down in deglutition, but whose action is not concerned in moderating the aperture of the glottis; while the larynx itself and the aspera arteria remain free.

But when the respiration is pinched, besides other parts, these muscles, which are employed in opening and shutting the glottis, must be inflamed; and likewise, probably the inner membrane of the larynx, and those muscles and fibres that join the rings of the aspera arteria together: And sometimes these minute and remote parts are affected without any redness or tumour, either within the fauces, or outwardly on the throat: This kind of quinsy is the most dangerous and suddenly destructive of all.

The practitioner in every kind of quinsy ought to look carefully into the mouth and fauces, in order to discern where any redness and tumour is; that by comparing the appearance of the parts with the functions impaired, he may be enabled to form the better judgment with respect to the seat of the disease, the prognostic, and method of cure.

If the breathing is remarkably affected, there is absolute necessity of applying all the most efficacious remedies with the greatest briskness and speed possible. These are plentiful and repeated bleedings, a large blister between the scapulae; fomentations and cataplasms outwardly; steams to be received into the throat, the best ingredient in which is vinegar; smart, but cooling purges; or, if these cannot be got down, clysters of the same kind; bathing the feet and legs in warm water, and even semicupia not made too hot, for fear of raising the pulse too high.

But even though the respiration should not be affected at first, if the symptoms are otherwise violent, remedies ought to be smartly and quickly applied to prevent suppuration. For when the inflamed part tends to suppuration, the tumour keeps increasing; and when the pus is actually formed, the bulk may be so enlarged as to endanger suffocation, or the patient may be starved by a total privation of swallowing; so that suppuration should always be prevented, if possible.

If in the course of the distemper the patient should run a risk of being suffocated, the operation of bronchotomy becomes necessary. See SURGERY.

*Of the Malignant QUINSEY, or Putrid SORE THROAT.*

THIS disease generally comes on with such a giddiness of the head, as often precedes fainting, with a chilliness or shivering like that of an ague fit, followed by great heat; and these alternately succeed each other for some hours, till at length the heat becomes constant and intense. The patient then complains of an acute pain in the head, of heat and soreness, rather than pain, in the throat; stiffness of the neck; commonly great sickness, vomiting or purging, or both. The face soon after looks red and swelled, the eyes inflamed and watery, as in the measles; with restlessness, anxiety, and faintness.

It frequently seizes the patient in the fore-part of the day; and as night approaches the heat and restlessness increase, continuing till towards morning; when after a short, disturbed slumber, the only repose during several nights, a sweat breaks out, which mitigates the heat and restlessness, and gives the disease sometimes the appearance of an intermittent.

If the mouth and throat be examined soon after the first attack, the uvula and tonsils will appear swelled; and these parts together with the velum pendulum palati, as well as the cheeks on each side, near the entrance into the fauces, and as much of the fauces and the pharynx behind as can be seen, appear of a florid red colour. This colour is commonly most observable on the posterior edge of the palate, in the angles above the tonsils, and upon the tonsils themselves. Instead of this redness, a broad patch, or spot, of an irregular figure, and of a pale white colour, surrounded with a florid red, is sometimes to be seen. This whiteness is commonly like that of the gums after having been pressed with the finger; or as if a matter ready to be discharged lay underneath.

Generally on the second day, the face, neck, breast, and hands, are of a deep erysipelatous colour, with a sensible tumefaction. The fingers are so frequently tinged in a remarkable manner, that it has been no hard matter to guess at the disease from a bare sight of them.

A great number of small pimples of a more intense colour than that which surrounds them, appear on the arms and other parts. Where the redness is least intense, they are larger and more prominent, which is generally on the arms, breast, and lower extremities.

As the skin becomes red, the sickness commonly goes off, and the vomiting and purging cease.

The appearance in the fauces continues the same, only the white place becomes of a more opaque white, and is discovered to be a slough, concealing an ulcer of the same dimensions. These ulcerations are generally first discernible in the angles above the tonsils, or on the tonsils themselves. They are also often seen in the arch formed by the uvula and one of the tonsils; on the pharynx behind, on the inside of the cheeks, the basis of the tongue, which they cover like a thick fur. Where the disorder is mild, there is only a superficial ulcer, of an irregular figure, in one or more of those parts, scarce to be distinguished from the sound part, but by the inequality of its surface. Likewise the redness and eruption do not always appear, and in some not till the third, fourth, or fifth day, or later.

The parotid glands on each side commonly swell, grow hard, and are painful to the touch; If the disease is violent, the neck and throat are surrounded with a large œdematous tumour, sometimes extending itself to the breast, and by straitening the fauces increase the danger.

Towards night the heat and restlessness increase, and a delirium frequently comes on. This happens to some on the first night. It is very remarkable, that the patient commonly returns a proper answer to any question, but with unusual quickness; yet when they are alone, they generally talk to themselves incoherently. However, at the first tendency to this disorder, they affect too great a composure. This for the most part happens to those that sleep but little; for some are comatose and stupid, and take but little notice of any thing that passes.

They continue thus for three, four, or more days, commonly growing hot and restless towards the evening. These symptoms and the delirium increase as the night comes on: a sweat, more or less profuse, breaks out towards morning; and from this time they are easier during some hours, with a faintness, which is their chief complaint.

Some grow easier from the first day of the attack; others have symptoms of recovery on the third, fourth, or fifth day. First the redness of the skin disappears; the heat grows less; the pulse, hitherto very quick, becomes slower; the external swellings of the neck subside; the sloughs in the fauces are cast off; the ulcerations fill up; the patient sleeps without confusion, is composed when awake, and his appetite begins to return towards more solid nourishment.

The pulse, during the course of this disease, is very quick, beating frequently 120 times in a minute. In some it is hard and small, in others soft and full, but not so strong and firm as in genuine inflammatory disorders.

If a vein be opened soon after the distemper comes on, the blood generally appears of a fresh and florid red; the *crassamentum* is rather of a lax, gelatinous contexture, then dense or compact; the serum is yellow and in a large proportion.

The urine is at first crude and of a pale whey colour; as the disease advances it turns yellow, as if bile was diluted in it; and soon after any signs of recovery appear, it commonly grows turbid, and deposits a farinaceous sediment.

They seldom have any stools if the symptoms are favourable, from the time the purging, which generally attends the accession, ceases. This discharge is remarkably bilious, yet without pain.

The thirst is commonly less than in other acute diseases; and the tongue generally moist, but not furred. Some have it covered with a thick white coat, and complain of soreness about the root of the tongue.

Though the uvula and tonsils are sometimes so much swelled as to leave a very narrow entrance into the gullet, and this entrance frequently surrounded with ulcers, or sloughs; yet the patient swallows with less difficulty and pain than might be expected. Soon after they are taken ill, they frequently complain of an offensive putrid smell, which often occasions sickness before any ulcerations ap-

pear. The inside of the nostrils, in those that have this disease severe, frequently appears, as high as can be seen, of a deep red or almost livid colour. After a day or two, a thin corrosive sanies, or with it a white putrid matter, of a thicker consistence, flows from it, so acrid as to excoriate the part it lies upon any considerable time. This is most observable in children, or in young and very tender subjects; whose lips are likewise frequently of a deep red, or almost livid colour, and covered on the inside with vesicles containing a thin ichor, which excoriates the angles of the mouth and cheeks where it touches them.

This acrid matter seems to pass with the nourishment into the stomach, especially of children; for if they get over the disease, a purging succeeds, yet attended with symptoms of ulcerations in the bowels: these, after great pain and misery, at length die emaciated.

The patients sometimes bleed at the nose towards the beginning of the disease; and the menses often appear in the female sex, if they are of age, soon after they are seized, though at a distance from the time of their regular period. It brings this evacuation upon some that never had it before. This flux, in full strong habits, is seldom attended either with benefit or with manifest ill effects, unless very copious; yet sometimes it occasions great faintness, and an increase of the other symptoms. Hæmorrhages of the nose and mouth have carried the patient off suddenly: but this does not happen till several days after the attack; and perhaps may be owing to the separation of a slough from the branch of an artery.

Children and young persons are more exposed to this disease than adults; girls more than boys; women more than men; and the infirm of either sex than the healthy and vigorous. Very few grown people have it. When it breaks out in a family, all the children are commonly infected with it, if the healthy are not kept apart from the sick. And such adults as are frequently with them, and receive their breath near at hand, often undergo the same diseases.

With regard to the cure, bleeding is generally prejudicial. Some admit of it at the first attack without any sensible inconvenience; but a repetition of it in the mildest cases seldom fails to aggravate the symptoms; it has sometimes produced very fatal consequences. It increases the heat, restlessness, delirium, and difficulty of breathing; nor do the swelling of the fauces, tonsils, &c. receive any benefit therefrom. On the contrary, though the fullness of these parts decreases, yet the sloughs thicken and change to a livid black colour, the external tumour grows large, and the spitting commonly diminishes. Indeed, the heat and quickness of the pulse may seem to abate at first by this evacuation; but they commonly return with greater violence, the patient is seized with a difficulty of breathing, falls into cold sweats, a stupor, and dies suddenly.

Nor is purging more beneficial; even gentle cathartics have brought on very dangerous symptoms. Upon procuring a few stools with manna, especially when the disease has continued two or three days, the redness of the skin has disappeared, and the flux to the throat has been surprisngly increased. If this discharge by stool continues,

tinues, the swelling of the neck commonly grows larger, the fauces become flaccid, dry and livid; and the patient a few hours after this expires.

Nitrous cooling medicines frequently produce the like effects; they increase the faintness which accompanies this disease, and either dispose the patient to copious sinking sweats, or stools.

Upon the whole, it appears, that all evacuations which tend to lessen the natural strength of the constitution, are injurious; and those persons are commonly in the greatest danger who have been previously indisposed, or their strength impaired by grief.

If the purging, therefore, continues long after the first exacerbation of the disease, it is a dangerous symptom; for though it may sometimes be restrained for the present with opiates or astringents, yet it commonly returns with greater vehemence when their efficacy ceases, and in a short time exhausts the small degree of strength remaining. In this case they generally sweat very little; the fauces appear dry, glossy, and livid; the external tumour grows large; they void their excrements without perceiving it, and fall into profuse sweats; the respiration becomes difficult and laborious, the pulse sinks, the extreme parts grow cold, and death, in a few hours, closes the scene. The eye loses its lustre, and becomes, opaque and dim, sometimes several hours before death.

A copious flux of pituitous matter to the glands and other parts about the fauces, have seemed sometimes to be the cause of sudden death.

It is necessary that the patient should be kept in bed as much as may be, though the disease should seem to be slight; for a purging has come on for want of care in this respect, the redness of the skin disappeared, and a disorder which with confinement alone would probably have gone off in twice twenty-four hours, has been rendered tedious and difficult.

At the first, while the sickness and vomiting continue, it will be best to promote the discharge, by giving an infusion of green tea, camomile flowers, carduus, or a few grains of ipecacuanha.

If the symptoms do not abate by this means, give small draughts of mint-tea, with a sixth part of red port, frequently, together with some warm and cordial aromatic medicine, every four or six hours.

The diarrhoea, as well as vomiting, generally ceases in less than twelve hours from the first attack: If it continues longer, it is necessary to check it; otherwise it occasions great faintness, sinks the strength, and in the end produces dangerous consequences. The aromatic cordials commonly take off this symptom, if given plentifully, and the vomiting likewise.

Patients generally complain of an excessive faintness soon after they are taken ill. The urgency of this symptom seems to indicate the degree of danger; and an abatement of it is a pretty sure presage of recovery. Aromatic medicines are likewise found useful in removing this symptom. Wine may be given in small quantities in whey, or mint, baum, or sage-tea, barley-water, gruel, panada, sago, and the like; for it is not only an antiseptic, but a generous cordial. When the faintness is excessive, it may be given alone.

Blisters likewise relieve faintings; they may be applied with advantage to the usual parts, and to the neck on each side, from below the ear almost to the clavicle, as occasion requires.

With regard to the ulcers, which demand our early and constant attention: When the disease is of the mildest kind, only superficial ulceration is observable, which may escape the notice of a person unacquainted with it. A thin, pale, white slough seems to accompany the next degree; a thick, opaque, ash-coloured one is a farther advance; and, if the parts have a livid or black aspect, the case is still worse. These sloughs are real mortifications of the substance; since, whenever they come off, they leave an ulcer of a greater or lesser depth, as the sloughs are superficial or penetrating.

The thin, acrid ichor, which is discharged from under the sloughs, often proves of bad consequence, especially to children. If gargles are injected, they either prevent them from reaching the seat of the disorder with their tongues, or they swallow them and the putrid taint of the ulcers together; whence fatal purgings ensue, or fatal hæmorrhages from the penetrating gangrene. Those that have a plentiful discharge from the fauces, carrying off this ichor, are seldom attended with sickness, vomiting, or excessive faintness; and where there is little or no discharge, the symptoms are commonly most dangerous.

Hence the great advantage of gentle stimulating aromatic gargles appears; because they promote the discharge of pituitous matter, and, doubtless, some part of the corrosive fluid along with it. To which, if we add antiseptics and detergents, to check the progress of the mortification, and to cleanse the sordid ulcers, every indication will be answered.

When the disease is mild, the symptoms favourable, the sloughs superficial, order a gargle of sage-tea, with a few rose-leaves in the infusion. Three or four spoonfuls of vinegar may be mixed with half an ounce of the tea, with as much honey as will make it agreeably acid.

If the sloughs are large, and are cast off slowly, they may be touched with mel ægyptiacum, by means of an armed probe.

It is not uncommon for hectic heats, night sweats, want of appetite, and dejection of spirits, to attend those a considerable time who have had the disease in a severe manner. Asses milk commonly relieves them, together with a decoction of the bark and elixir vitrioli.

The cause of this disease seems to be a putrid virus, or *miasma sui generis*, introduced into the habit by contagion, principally by means of the breath of the sick person.

The intentions of cure in this disease is to keep up the *vis vitæ*; to encourage the cuticular discharges; and to conquer the spreading putrefaction. Therefore, all evacuations which lessen the strength, particularly bleeding and purging, and all the nitrous antiphlogistic medicines, are highly improper.

And since a laxity of fibres predisposes persons to receive this disease, it is manifest, both with regard to the preservation and cure, tonic medicines are indicated; and among those the bark justly claims the first place.

The:

The only certain diagnostics of this disease are aphthous ulcers and sloughs on the tonsils and parts about the pharynx.

Most persons in the beginning have a nausea and vomiting, and some a looseness. Those who are costive, have, upon the use of the gentlest eccoprotics, immediately been seized with a diarrhœa, difficult to restrain. All medicines which tend to move the belly, not excepting rhubarb, are extremely dangerous.

Those who have had the disease with most violence, have had the head always heavy and stupid, and the eyes foul and full of tears. Not a few have had the head covered with petechiæ and purple spots.

The first thing to be done is to order the hot steam of a boiling mixture, of vinegar, myrrh, and honey, to be received into the throat, through an inverted funnel. If it is necessary to make it still more penetrating, add some of the *spirit. Mindereri*. This steam can scarce be used too frequently, provided it is received with a due degree of heat.

If the *primæ viæ* seem foul, or much loaded, it may be necessary to begin the cure by cleansing the stomach with carduus tea, in which a little sal vitrioli is dissolved, and some other gentle and quick emetic. No other evacuation seems proper, and this is only to be used at the very beginning of the disease. If the physician is not called in soon enough, it will be necessary to begin immediately by giving the bark, joined with the *spir. Mindereri*.

The bark is most efficacious in substance; but when the strength of the patient is much reduced, and the digestive powers weakened, which is usual in putrid fevers, on the very first seizure, the decoction or extract may be thought preferable; but this last is seldom to be had genuine. In making the decoction, it ought to be done with as gentle a heat as possible, and then evaporate very slowly to procure the extract, lest it be burnt too, and that the volatile parts may fly off as little as may be.

In the use of the *spiritus Mindereri*, care should be taken that it be exactly neutralized; or rather, as the disease is putrescent, that it may incline towards the acid. This is particularly of use where the heat is very great, it being very attenuating and antiseptic.

When the putrefaction is sufficiently conquered, it will be necessary to cleanse the first passages with a small dose of rhubarb; which is to be repeated at proper intervals, continuing the bark, &c. on the intermediate days for a considerable time.

To complete the cure, the patient should enter into a course of balsamics, chalybeate waters, with elixir vitrioli, and the like, in order to strengthen the solids and invigorate the blood; for this disease is liable to return, especially if they have afterwards a fever of the putrid kind.

#### Of a PHRENZY.

A PHRENZY, if a primary disease, is a true inflammation of the dura and pia mater; if symptomatical, the inflammatory matter is translated into the meninges of the brain from some other part.

The primary phrenzy is preceded by heat and a violent

inflammatory pain within the head, a redness of the eyes and face, unquiet and troubled sleep, a slight degree of folly, watching, sadness, fierceness, sudden forgetfulness, a gathering of threads from the bedcloaths.

A symptomatic phrenzy succeeds any acute disease; but it is worst when it is preceded by an inflammation of the pleura, lungs, or diaphragm. A black tongue, an obstinate costiveness, suppression of urine, white fæces, which is always a fatal sign, pale, discoloured, thin urine, a wildness in the looks and actions, with a red visage, a black cloud in the urine, and watching, are signs of an approaching inflammation in the head.

The symptomatic phrenzy sometimes appears in the state of malignant, eruptive, and spotted fevers, the small-pox, malignant catarrhal fevers, camp-fevers, particularly the Hungarian. It generally supervenes about the critical days, with a rigor, trembling of joints, tension of the præcordia, and coldness of the external parts, with thin urine. The patient being weakened with the preceding disease and long watching, which debilitates the tone of the vessels of the membranes of the brain; whence the stases are not to be resolved, and whence the patient is generally killed on the third day.

A phrenzy is to be distinguished from that slight alienation of mind which happens in acute fevers before the critical eruption. This goes off readily, nor is the urine thin and watery, nor is it attended with a rigor and a refrigeration of the external parts. It is also to be distinguished from a desipience and raving, from a great loss of strength and weakness of the brain after the declination of an acute fever; for this will go as the strength returns, either spontaneously, or with proper remedies.

Both kinds, when present, have the following symptoms:

A deprivation of the ideas of sensible things, as also of the faculties of the mind and affections; an unruly fierceness and wildness; an unquiet and often turbulent sleep, a respiration slow and great, the face often exceeding red, the aspect grim, the looks fierce, the eyes wild and protuberant, a dropping of the nose.

A phrenzy is generally fatal on the third, fourth, or seventh day; which last it seldom exceeds.

When it does, and is violent, it often ends in madness; which increasing gradually, the patient becomes raving mad.

The aliment ought to be slender, of farinaceous substances, as water-gruel acidulated; the drink, barley-water, small-beer, or the decoction of tamarinds.

This disease, of all others, requires the speediest applications. Profuse hæmorrhages of the nose often resolve it; and copious bleeding, by opening the temporal arteries, is the most efficacious remedy.

The cure of this disease requires diligent attention to the following things:

Varices of the veins, or the bleeding piles, are beneficial.

A looseness is likewise good.

A pain in the breast and feet, or a violent cough supervening, often put an end to the disease; as also an hæmorrhage.

Therefore plentiful bleeding is necessary, through a large

large orifice; or open several veins at the same time, *viz.* the *jugular*, the *frontal*, and a vein in the foot.

Hoffman prefers the bleeding at the nose, procured by thrusting up a straw, a pen, or a skewer; or, as Pringle advises, apply six or seven leeches to the temples. The rest of the cure consists in blisters, and things common to other inflammatory fevers.

The cure of the symptomatic phrenzy, if the pulse will bear it, is by opening a vein; but if this cannot be done by reason of great lowness, it is to be attempted by leeches and blisters. It is usual to begin with blistering the head, but in military hospitals that is to be left to the last. The best internal medicines are nitre and camphor. Hoffman's proportion is six grains of nitre to one of camphor; small doses of which are to be often repeated.

The patient's drink should be sweet whey, or acidulated by turning the milk with citron or lemon juice, and sweetened with *syr. e meconio*. To every quart add a dram of purified nitre or sal prunella. Also emulsions are convenient, of the four cold seeds, with barley-water, to every quart of which add two scruples of nitre.

Antiphlogistic clysters are likewise proper: but if all these means fail, recourse must be had to cupping in the lower parts, to opiates, and mild blisters.

#### Of the PLEURISY.

THE pleurisy is most predominant between the spring and the summer.

It begins with chills and shivering, which are soon succeeded by heat, thirst, inquietude, and the other common symptoms of a fever.

After a few hours the patient is seized with a violent pricking pain in one of his sides, about the ribs; which sometimes extends itself towards the shoulder-blades, sometimes towards the back-bone, and sometimes towards the fore-parts of the breast; and this is attended with frequent coughing.

The matter which the patient spits at first is little and thin, and mixed with particles of blood; but as the disease advances, it is more plentiful and more concocted, but not without a mixture of the blood.

The fever keeps an equal pace with the cough, pain, and spitting of blood; and in proportion as the expectoration becomes more free, it sensibly decreases; sometimes the body is costive, sometimes too open.

The blood drawn from a vein, as soon as it is cold, looks like melted suet.

In this disease the pulse is remarkably hard, and seems to vibrate like a tense string of a musical instrument, which is the pathognomonic sign.

Hence pleurisies are distinguished into the moist and the dry. It is likewise observable, that the pain in the side is more intense at the time of inspiration, but more mild at the time of expiration.

There is no fever wherein the crises are more regular than in the pleurisy and peripneumony: for in young persons, and those of a full habit of body, bloody spittle generally appears on the fourth day, and on the seventh the disease terminates by a profuse sweat. But in the phlegmatic and more inactive, as also those in whom the disease

has taken deeper hold of the lungs, it will continue till the eleventh or fourteenth day; going off partly by expectoration, partly by sweat: then the pulse becomes more soft, and the patient falls into an easy refreshing sleep.

But when on critical days the crisis is imperfect, there is indeed a sweat; but it neither eases the patient, nor terminates the disease. When it continues till the twenty-first day, there is reason to fear a dangerous abscess in the breast. It is therefore a good sign when the expectoration proceeds from the bottom of the lungs, bringing up a viscid matter on the fourth day, mixed with blood, afterwards yellow, and sometimes purulent. The sooner the expectoration happens, the greater the hopes of recovery.

A looseness is not safe; urine without a sediment is a suspected sign; and a profuse sweat, unless on critical days, is still worse. On the eleventh and twelfth days a looseness is not much to be feared, unless too great, for it sometimes carries off purulent matter. If a bleeding at the nose happens about the fourth day, it is generally attended with a remarkable alteration of the disease.

Those who die of an inflammation of the lungs are suffocated, because the matter adhering to the vesicles and bronchial ducts cannot be coughed up.

In all inflammatory fevers, too hot a regimen is to be shunned, both with respect to the bedcloaths and the heat of the room; nor must the patient be exposed to the cold air, nor drink things actually cold. Likewise all strong sudorifics, diuretics, and cathartics, are hurtful. Nor, if the patient has three or four stools, must the course of nature be stopped.

The Diet should be cooling, relaxing, slender, and diluting. Moistening things taken warm are preferable to all others. Hence, barley or oat meal gruel, sweetened with honey, is proper; as also sweet whey.

The indications of cure are, 1. To prevent the farther stasis and stagnation of the blood. 2. To dilute and dissolve the lentor of the blood in pleuritics. 3. To mollify, ease, and relax the spasm, pain, and copious afflux, in order to put the impacted blood again into motion by the help of the appulse of the arterial blood. 4. To promote the excretion of the viscid, bloody, and virulent matter, adhering to the bronchia of the lungs, so that it may be brought up and an abscess prevented.

Take away ten ounces of blood on the side of the part affected. If the physician is called before the third day, the patient lying on his back, must lose a large quantity of blood from a wide orifice in a large vessel, and fetch deep sighs, or cough, to promote its celerity; and the part affected should be rubbed gently at the same time. The bleeding should be continued till the pain remits, or the patient is ready to faint. It should be repeated as often as the symptoms return which it was intended to remove. The absence of the white inflammatory pellicle from the surface of the blood, when cold, shews it is time to leave it off. This Huxham confirms by his own experience; and adds, that after the fourth day bleeding is not safe. He likewise recommends fomenting the part; which often eases the pain, and terminates the disease. But if it is obstinate, he recommends slight scarifications; then cupping; and

and afterwards a blister on the same place, which has been successful when the usual methods failed. An emollient cooling clyster should immediately succeed bleeding, especially if the body is costive; and nitrous medicines, with a cooling, emollient, diluting regimen, should be forthwith entered upon. Thin whey, a decoction of barley and red poppies, and emulsions, will serve for drink.

Though the symptoms should vanish on blistering, it will be more secure to bleed again; unless a profuse sweat comes on with relief from pain, and makes all other remedies unnecessary. But if the lungs are likewise inflamed, the cure cannot be so speedy; for though the first bleeding and a blister should give ease, yet a repetition will be needful. Sometimes the stitch returns and fixes on the other side; but this may be treated as the first with the same success.

Huxham lays a great stress on camphor and nitre joined with small doses of the paregoric elixir; and if there is a vehement pain, he thinks opiates may properly be joined with them, as they have a great power of relaxing the over tense fibres, of moderating the too rapid course of the blood, and of promoting the concoction of the morbid matter. Hence, after the use of opium, there is generally a copious sediment of the urine.

It is necessary that the body be kept open, and the bowels free from spasms; to which purposes emollient clysters are proper, with oil of sweet almonds.

In the first stage of the pleurisy or peripneumony, laxative clysters and the cooler diaphoretics are proper; but all cathartics and warm sudorifics do harm. The time for attempting the diaphoretics is when the person finds ease by the blister: But whenever the spitting begins, the diaphoresis must either be omitted, or joined to expectorants; whereof the chief is oxymel of squills; or, in great heat or drought, some more pleasant acid. But in lowness, after repeated bleedings, give salt of hartshorn joined to some oil: This will raise the pulse, and promote expectoration when it flags.

If, notwithstanding the discharge, the breast continues to labour, bleeding is still requisite: For the lungs are not to be overpowered by the omission of bleeding; nor is the suppression of the spitting to be hazarded by bleeding too freely. But with regard to blisters, there need little caution; as they are always seasonable, to raise, relieve the breast, and to promote expectoration.

In the course of expectoration, a vomit will sometimes be useful in discharging the load of viscid phlegm. If the phlegm is tough, or the patient costive, and opiates are given, they must be joined with squills.

When the pleurisy ends in a suppuration, or abscess, the signs are, a slight vague shivering, which often returns without any evident cause; a remission of the pain, while the difficulty of breathing remains; a redness of the cheeks and lips; thirst; a febricula, or slight fever, especially in the evening; a weak, soft pulse.

When the abscess is actually formed, there is an obstinate dry cough, which increases after feeding or motion; the breathing is difficult, small, thick, short, and wheezing, worse after eating and motion; the patient can only lie on the side affected; a slow, periodical fever,

which is exasperated with stirring and eating; a decayed appetite, great thirst, nocturnal sweats, paleness, leanness, and excessive weakness.

This either ends in a consumption; or the matter falls into the cavity of the thorax, and so becomes an empyema.

#### *Of the BASTARD PLEURISY.*

HOFFMAN says, that the seat of every genuine pleurisy is in the lungs, as appears from the opening of those that die of this disease.

Therefore, if the inflammation occupies the external parts only, it is a BASTARD PLEURISY: if the external surface of the lungs, like an erysipelas, it is a genuine pleurisy.

A BASTARD PLEURISY is attended with a very acute and pricking pain in the side, which is exasperated by the touch; lying on the affected side is difficult; there is a dry cough, without the ejection of purulent or bloody matter, which, if strong, increases the pain. There is likewise a fever, with a hardish, depressed, and frequent pulse.

The cause does not seem to be in the blood, but rather in the stasis of an acrid serum at the connection of the ends of the fine azygous arteries and veins; as also of the lymphatic vessels of the pleura, and likewise in the periosteum of the ribs, where the sense is more acute.

Hence it is nothing else but a kind of rheumatism, and is common to those who are now and then troubled with catarrhs, rheumatic and arthritic pains, or a hemicrania; especially if they come out of a hot air into a cold, or the contrary, particularly in the evening.

This does not require bleeding, unless there is a remarkable plethora; but a diaphoresis, and a more free perspiration. On the seventh day it generally disappears, and is without danger.

Lanciscus advises to bleed plentifully in the arm, and to scarify the part affected. After this two cupping glasses are to be applied thereto, which will cure the disease as if by enchantment.

Hoffman observes, that those are apt to fall into a bastard pleurisy who are much exposed to a moist cold autumnal or wintery air: For there are no diseases or inflammatory fevers so soon generated by the intemperies, inequality, and change of the air, as those of the breast. When the summer has been hot and dry, and the weather has suddenly changed to cold, with a northerly wind, not only catarrhal fluxions have ensued, but rheumatisms and pleurisies, with bloody spittle and violent pains in the side, have been very frequent. For the air, from continual inspiration, immediately affects the lungs internally, and externally the thorax and ribs, which are beset with thin muscles, membranous nerves and vessels; for which reason spastic crispatures are readily induced; and the free circulation of the humours stop.

The best way is to keep the part affected in a temperate and equal heat, in a warm bed; especially as the skin of every patient, as in the gout and erysipelas, cannot bear topics.

*Of a PERIPNEUMONY.*

THERE are several kinds of this disease. For it may arise from a violent inflammation of the lungs, by a very sily dense blood obstructing very many of the pulmonic and bronchial arteries: or from an obstruction of the lungs by a heavy, viscid, pituitous matter; which is called a spurious or bastard peripneumony: or from a thin, acrid defluxion on the lungs; and then it is a catarrhal peripneumony.

The symptoms common to all, are, a load at the breast, a short difficult breathing, and more or less of a fever. But in a true peripneumony, there is a more tensive pain than in the pleurisy; besides, it is rather more obtuse and pressing than acute, and shoots as far as the back and scapulae. But the difficulty of breathing is greater, as well as the anxiety and expectoration, whereby a variegated spittle is brought up, which lay as it were deep: for in this disease the vessels of the lungs themselves, whereby the blood circulates from one ventricle of the heart to the other, are affected; being stuffed and obstructed with a thick blood, which is apt to grow more viscid and solid. Wherefore it is the more dangerous and fatal, especially if it attacks old persons, and if bleeding is not timely administred. Boerhaave says, the pulse is soft, slender, and in every sense unequal; and Huxham, that if the pulse is hardly felt before bleeding, it will afterwards bear very strongly.

In the cure, great regard must be had to the different stages of this disease, and the different symptoms that attend it. Bleeding is indispensably necessary at the beginning of a severe inflammation of the lungs; but if, after the second or third bleeding, the patient begins to spit a well concocted matter, freely tinged with blood, you must forbear to repeat it, otherwise the patient will be weakened, and a fatal suppression of the expectoration will ensue. But if he brings up a considerable quantity of florid, thin, spumous blood, by spitting; then bleed again, quiet the cough with diacodium, and give proper acids pretty freely, with soft cooling inkrasants. If a thin, gleety, dark-coloured matter is expectorated, it is generally a mark of greater malignity, and that the blood is in a putrefying dissolving state, and will not bear a large loss of blood.

Generally the more violent the rigor or horror is at the attack, the more violent the succeeding fever will be, which will in some measure guide us in drawing of blood. If the symptoms are not relieved by the first bleeding, after eight, ten, or twelve hours, let it be repeated; or sooner, if they become aggravated. If the fever, anxiety, oppression, and difficulty of breathing, increase, bleed again, especially if it appears very firm and dense, or covered over with a thick yellowish coat or buff. However, it does not appear sometimes till the second or third bleeding, though the symptoms indicate a very high inflammation. This often happens from the blood not spouting out in a full stream. This appearance of the blood, with a firm strong pulse, will warrant the taking away more, till the breathing becomes free and easy.

If the crassamentum is of a very loose texture, and not covered with a buff coat, and the pulse on bleeding sinks,

flutters, or grows more weak and small, it is time to desist. A bluish film on the blood, with a kind of a soft greenish jelly underneath, while the cruor itself is livid, loose and soft, with a turbid, reddish, or green serum, is a sign of a very lax crasis of the blood, and great acrimony, which will not bear great quantities to be drawn off. If the blood is very florid, thin and loose, with little or no serum after standing for some time, it generally argues a considerable advance to a putrid and very acid state.

A strong, throbbing, thick pulse, always indicates farther bleeding; at least till the patient breathes more easily, or a free expectoration of laudable matter is obtained. It often happens, that the pulse at the very beginning seems obscure and oppressed, irregular, sluggish, and sometimes intermitting, with weakness and oppression. But this does not arise from the defect, but from the too great quantity of blood; for the blood-vessels being over-loaded and distended, cannot act with sufficient vigour. This is succeeded with a dreadful train of symptoms, and even death itself, if not prevented with sufficient bleeding.

In some very violent peripneumonies, an immediate and excessive weakness comes on, with an inexpressible anxiety and oppression of the breast; a very small, weak, trembling pulse, coldness of the extremities, with clammy, coldish, partial sweats, the eyes staring, fixed and inflamed, the face bloated and almost livid. This has soon been followed with a stupor, delirium, and sometimes with a complete paraplegia.

Some kinds of peripneumonies will not bear large bleeding, especially the epidemic or malignant. The pulse and strength of these patients have sunk to a surprising degree; and the disease has turned into a sort of a nervous fever, with great tremors, subfultus tendinum, profuse sweats, or an atrabilious diarrhoea, with a black tongue, coma, or delirium; though at the beginning the pulse seemed to be full and throbbing, and the pain, cough, and oppression so very urgent, as to indicate bleeding pretty strongly. In these cases the blood was seldom buffy to any considerable degree, but commonly very florid, of a very loose and soft consistence, or very dark-coloured, and coated with a thin and bluish or greenish film, under which was a soft greenish jelly, and a dark livid cruor at the bottom. Sometimes the coat was much thicker and more tough, but of a pale red colour, resembling the cornelian stone, or a dilute jelly of red currants. When the blood is thus dissolved, abstain from farther bleeding, especially if the pulse or patient becomes more languid after it, though the oppression, load, or even pain, may seem to require it.

When the sily coat on the blood is excessively tough, and extremely yellow, or of a pale red colour, it threatens danger; for the inflammatory lentor will scarcely mix with any diluents. Sometimes, after repeated bleeding, the crassamentum has scarce been a sixth part of the volume of the blood, and yet as solid as a piece of flesh. This is generally mortal.

When the peripneumonic symptoms continue for four or five days or more, we may justly fear an abscess, or a mortification; and little advantage is to be expected from farther

farther bleeding. But if the pain returns with violence after having ceased a considerable time, it is a sign that a new inflammation is forming, which indicates bleeding as much as the primary, but not in the same degree. The strength of the patient and pulse, the violence of the pain and difficulty of respiration, are, in a great measure, to determine the quantity. When the pulse and strength seem to require bleeding, cupping on the shoulders will relieve the breast and head. Likewise the use of blisters, issues, setons, are very serviceable in inflammations of the lungs.

Laying a blister on the part affected is the proper cure of a pleurisy; but a peripneumony is naturally more dangerous; and the more so as the epispastic cannot operate so directly on the lungs as the pleura. But even in this case, blistering is most to be relied on after bleeding. You may first blister the back, and afterwards one or both sides. Epispastics tend to relieve the breast, not only when applied to the chest, but also to the extremities; and promote expectoration: Whereas bleeding must be used cautiously, if at all, after the spitting appears.

The fever and the inflammation require a cool, diluting regimen, and nitrous and relaxing medicines; together with a moderately cool, free air, and quiet both of body and mind. A close room is very inconvenient; if it cannot be avoided, it should be prudently aired. There is nothing more proper than thin whey, a barley ptisan with liquorice, figs, &c. the infusion of pectoral herbs, such as ground-ivy, maiden-hair, colt's-foot, hyssop, &c. These should be gently acidulated with juice of Seville oranges or lemons. Honey will render them more detergent. Any or all these things may be drank warm by turns in frequent small draughts, sipping them as it were perpetually. These relaxing, emollient drinks, and vapours arising from them, are in a more essential manner necessary, when the expectoration is very difficult and tough. When it is suddenly suppressed, and the difficulty of breathing greatly augmented, an emetic of oxymel of squills will be proper, if the violence of the fever is abated; but very little should be drank after it to promote vomiting.

When much sincere, florid, or frothy blood is spit up, take away as much blood immediately as the patient's strength will bear. If the hæmoptoe continues, bleeding in the saphæna will be found of the utmost service. Then direct cooling emulsions, nitrous, demulcent, and mucilaginous medicines; and vegetable and even mineral acids, if the spitting of blood is very considerable. The drink may be a decoction of red poppies, colt's-foot, and figs, acidulated with elixir of vitriol. The cough may be appeased with diacodium, or a soft linctus. But strong astringents and large doses of opiates are bad.

In a CATARRHAL PERIPNEUMONY, the matter expectorated is extremely thin and crude, and the defluxion so very acrid as to excoriate the wind pipe, causing an incessant and very violent cough. Here, a great loss of blood is not necessary; but some should be drawn in the beginning to abate the inflammatory disposition. Blisters should be applied early, and purgatives are proper to carry off the serous colluvies. A demulcent, pectoral ptisan is

proper to temperate the acrimony of the humours. It should be taken warm with mild diaphoretics, Coffee is a useful drink. Direct *diacodium*, or *elixir pectoricum*, to moderate the cough, in small doses often repeated; *sperma ceti*, *olibanum*, *myrrh*, and *camphor*, tend to incrassate the thin catarrhal humour, and abate the irritation.

In the PUTRID PERIPNEUMONY the expectoration is livid, gletty, and fœtid, frequently resembling the lees of red wine; sometimes more black, and sometimes very fetid. This is often the case of the highly scorbutic; particularly sailors, after a long voyage. Blood taken from these, appears to be in a dissolving putrescent state. The crassamentum is loose and tender, the serum turbid and reddish; the tongue is black; the teeth furred with a dark, thick fordes; the breath offensive; the urine high-coloured or blackish. Black spots, or a dysentery, frequently appear on the fifth, sixth, or seventh day. The pulse and strength sink after bleeding; sometimes a vast anxiety, fainting, a cold sweat, a thready intermitting pulse soon after. This has sometimes happened in pleuro-peripneumonies, where the pain of the side was violent, the load at the breast great, and the cough considerable.

This will never bear a second bleeding to advantage; seldom the first, unless there is a considerable degree of firmness and tension in the pulse. When there is reason to be diffident, order scarifications and cupping.

In this disease give a decoction of figs, colt's-foot, and red poppies, well acidulated first with juice of Seville oranges or lemons, and afterwards with *gas sulphuris*; or *elixir vitriol*, nitre, olibanum, myrrh, flowers of sulphur and bole may be administered, with *conserv. lujula*, rob of elder, currants, mucilage of quince-seeds, and *syrup. de rubeo idæo*: camphorated vinegar, with syrup of elder or raspberries, is an excellent medicine. A spoonful or two of these latter should be given ever and anon. Sound cyder, and wine and water with Seville orange or lemon juice, drank warm, promote expectoration when deficient. Tincture of roses with red poppy flowers, has moderated an inordinate defluxion of thin bloody ichor. However, oxymel of squills, and strong cinnamon-water, are frequently necessary to pump up the ichor, when a great rattling in the throat and difficulty of breathing indicate a vast quantity of it in the lungs. And yet the violence of the cough may be often appeased by elixir asthmaticum or diacodium. The patient is to be supported with sago, panada, hartshorn jelly, roasted apples, cream of barley, or thick gruel, with a little wine and juice of lemons, giving a little at a time, and often. Strawberries, raspberries, currants, cherries, may sometimes be indulged. At the close, the whole depends on a well-regulated diet. A toast with diluted red port wine, mulled with Seville orange-peel, mace, or cinnamon, and well acidulated, may be very useful. Blisters are seldom beneficial in this case, but often mischievous.

A very thin yellow spitting, either shews that nothing but the thinnest part of the blood is strained through the arteries of the lungs, or that the whole mass of blood begins to dissolve; that its bilious principles are highly exalted, and that all tends to a general putrefaction. It is commonly

monly attended with a violent cough, and expectoration is performed with exceeding great difficulty. Many times it is succeeded by an hæmoptæ from the rupture of the vessels; particularly when the tongue appears very red, smooth, dry, and shining, with a kind of livid bladders at the top.

The concocted matter of inflammatory obstructions of the lungs is partly spit off, and partly carried off by thick turbid urine in large quantities, depositing much reddish or yellow-coloured sediment; and sometimes partly by bilious stools. Nothing promotes this urine, and these stools, more effectually than laxative clysters. Sometimes the morbid matter is critically translated to the legs, to the great relief of the breast; and therefore, in severe pulmonic disorders, a derivation of the humours to the legs may be attempted by tepid bathing and blisters. The discharge from the ulcerated blisters must not be suddenly suppressed; for then the difficulty of breathing and cough will return, or a very great purging or profuse sweats will succeed.

If the patient is not relieved in eight days, the inflammation will end in a suppuration, and an abscess of the lungs, and sometimes in some other part of the body; the symptoms of which are an obdurate dry cough, which motion and taking of food will increase. The easiest posture in lying will be on the affected side; there will be a slow fever, with chillness and shivering at uncertain periods; exacerbations after motion or a repast; thirst, night sweats, a frothy urine, paleness, leanness, weakness. In this case, bleeding must be forborne; the diet must be mild, soft, incrassating, and more plentiful. Tepid vapours should be taken into the lungs, of decoctions of proper ingredients.

When by the symptoms and time the imposthume may be judged to be ripe, the vapour of vinegar itself, and any thing which creates a cough, as oxymel, exercise, and concussion, are proper. The sooner it is broke, the less danger to the lungs.

In this state, which is not absolutely desperate, the aliment ought to be milk, and the drink milk and barley-water, with gentle anodynes, that the patient may have some rest. If the inflammation ends in a gangrene, the case is desperate; if in a schirrus, incurable.

#### *Of the BASTARD PERIPNEUMONY.*

AT the beginning of the fever the patient is hot and cold by turns, is giddy upon the least motion, and complains of a rending pain of the head whenever he coughs; he vomits up every thing that he drinks; the urine is turbid, and intensely red; the cheeks and eyes look red and inflamed; his breathing is thick and short; the whole thorax is full of pain, and the straitness of his lungs, as often as he coughs, is perceived by the by-standers: whence the free course of the blood is prevented, which creates a stoppage of the circulation, and takes away all the symptoms of a fever, especially in those of a full habit of body; this may also happen from the blood's being overloaded with a great quantity of pituitous matter, which oppresses it so as to prevent a febrile ebullition.

This disease sometimes steals upon the patient unawares, with a slight weariness, a weakness, a general prostration

of the faculties of the mind, thick and short breathing, beginning with an oppression of the breast. The commotions it excites are so small, that the heat and fever are scarce sufficient to make the patient sensible of his danger. Afterward, slight shiverings which come on by fits, and the attacks of a gentle fever, appear; whence the difficulty of breathing and weakness suddenly increasing, bring on death.

When perpetual, laborious wheezing, great anxiety and constant oppression on the præcordia, comatous symptoms, cold extremities, and dark bad-coloured nails and visage come on, the patient is in immediate danger.

When comatous symptoms and a very difficult breathing remain after bleeding, cup and scarify the neck and shoulders. This has frequently had a surprising effect. When the case is very threatening, blister the scarifications.

After bleeding, let the patient have the following clyster, which must be repeated daily till the lungs are relieved.

Take 3 ounces of honey, the yolk of an egg, and 8 ounces of barley-water. Make them into a clyster.

Let the patient's diet be very slender, such as weak broths, sharpened a little with orange or lemon juice, and he may drink a weak mixture of honey and water; the steams of warm water may be taken in at the mouth.

Likewise let the legs and feet be bathed, and large blisters applied. Sydenham advises a repetition of the bleeding and purging alternately, every other day, or at greater intervals, as the strength and symptoms require. But he has generally found twice bleeding sufficient.

#### *Of the INFLAMMATION of the LIVER.*

WHEN the liver is inflamed, it compresses the stomach, diaphragm, and the neighbouring viscera of the abdomen; it stops the circulation of the fluids, hinders the generation and excretion of the gall, and all digestion. It produces a great many bad symptoms, as the jaundice, with all the diseases depending thereon; for the liver receives the reflux blood from almost all the parts of the abdomen, and is the chief instrument of almost all the digestions that are made there.

A fever, an inflammation, and pungent pain on the region of the liver and diaphragm, a tension of the hypochondria, yellowness of the skin and eyes, and a saffron-coloured urine, are signs of an inflammatory disposition of the liver.

It begins with cold and shivering, sometimes with vomiting and a fever, watching, difficult breathing, inquietude, and costiveness. This is a kind of rheumatic or erysipelatous fever, proceeding from a sharp viscid serum, lancingating the nervous fibrillæ. It is sometimes accompanied with a bastard pleurisy, to which it is akin.

It is not very dangerous, and rarely kills, unless the viscera are found.

Narcotics and sudorifics are to be shunned.

This disease terminates as other inflammations, being cured by resolution, concoction, and excretion of the morbid matter; or else in an abscess, schirrus, or gangrene.

During the first state, a warm regimen and saffron are improper.

Cooling resolving liquors, taken inwardly, as whey with

with ferrel boiled in it. Outward fomentations, and frequent injections of clysters, bathing, and frictions, relax, and render the matter fluid. Honey, with a little Rhenish wine, or vinegar; the juices and jellies of some ripe garden fruits; and those of some lactescent plants, as endive, dandelion, and lettuce, are resolvent.

Fat oily epithems, and plaisters, are to be shunned. Camphor in croceated spirit of wine is only to be used in the beginning, or when the fever is moderate, and nature sluggish. Bleeding at first is necessary on the affected side, in the hand or foot.

Violent purging hurts; gently relaxing the belly relieves; diluents, with nitrous salts, are beneficial, or tamarinds boiled in warm water or whey.

A clyster purely oleous is beneficial, with a bladder-full of an emollient decoction. Inwardly, diluting and resolvent mixtures.

If it is attended with the jundice, then apply epithems of *cardus benedictus*, scordium, wormwood, elder flowers, chamomile, seeds of lovage and cummin boiled in wine, and often applied.

Pringle says, the best remedy, after plentiful bleeding, is to lay a large blister over the part affected.

Bloody stools, not in an extreme degree, or streaked with blood, ought not to be stopped, because they help to resolve the distemper: bleeding at the nose often does the same.

The feverish matter is frequently carried off by urine; and therefore diuretics not highly stimulating are proper.

Sweating ought not to be promoted by hot cordials, but encouraged by warm diluting liquors.

The case is deplorable, when the inflammation terminates in a suppuration, unless the abscess points outwardly, so as it may be opened. For if the pus is evacuated into the abdomen, it produces putrefaction, or an incurable hepatic dysentery or bloody-flux.

#### *Of a PARAPHRENITIS.*

THIS disease is an inflammation of the diaphragm, and parts adjacent. A paraphrenitis is attended with a very acute continual fever, an intolerable inflammatory pain of the part affected; which is extremely augmented by inspiration, coughing, sneezing, repletion of the stomach, a nausea, vomiting, compression of the abdomen in going to stool or making water. Hence, the breathing is thick, short and suffocating, and performed only by the motion of the thorax. There is also a constant delirium; a drawing of the hypochondria inwards and upwards, an involuntary laughter, convulsions, and madness.

This disease terminates as in a pleurisy, and is attended with more violent symptoms, and is much more fatal. If the part affected suppurates, the matter will fall into the abdomen, and produce a purulent ascites.

The cure must likewise be attempted in the same manner as in a pleurisy.

#### *Of the INFLAMMATION of the INTESTINES.*

THIS disease contracts the intestines, and stops up the passage through them. There is a vehement, fixed, burning pain, which is irritated by things taken inwardly. When the inflammation is in the upper part of the inte-

stines, the stomach will be greatly distended by wind. When the pain is exasperated, it produces convulsions of the diaphragm and abdominal muscles, vomiting, painful inflations, with rumblings, and sharp griping pains which may bring on the iliac passion, or twisting of the guts.

When there is a burning pain in the abdomen, with a preternatural heat of the whole body, as also a quick pulse, loss of strength, anxiety, and inquietude, the seat of the disease may justly be suspected to be in the intestines. If the sharp pain is above the navel and below the stomach, attended with a fever, nausea, and reaching, it is a sign that that part of the colon is affected which lies beneath the stomach, and is extended from the right to the left-side. If the pain lies in the right hypochondrium, under the spurious ribs, it shews that part of the colon to be inflamed where it joins to the ilium. When the complaint is of the left side, under the loins, where the psoas muscle is placed, it is a sign the colon and that part of the mesentery joined thereto is the seat of the disease, especially when it adheres to the peritonæum. But when the pain is in the middle of the abdomen about the navel, it shews the small-guts are certainly affected. In all these cases the pain is supposed to be attended with a fever.

When there is a fever, and a burning pain in the lower part of the belly, attended with a swelling, which ends in a copious, putrid, or purulent flux, with a great disorder of the bowels, it shews the seat of the disease to be in the mesentery.

This disease should carefully be distinguished from a cholick proceeding from a cold cause, because what is good for the latter is poison in the former. It must have a speedy remedy, or it will soon end in the iliac passion or a mortification.

Besides copious bleeding, there is hardly any other method of cure than fomenting and relaxing the bowels with emollient liquids, taken warm both by the mouth and in clysters, and this every hour. Yet acids in very desperate cases have been known to give relief; such as the juice of lemons taken by the mouth, and vinegar and warm water given in clysters. When the vomiting is excessive and continual, opiates should be given to quiet the convulsions.

Pringle affirms in this case, that the best method of cure is to lay blisters over the part affected; and it has been practised with success. In particular they are useful in the ileus, and seem to answer equally well in the fixed pains of the bowels, whether from an inflammatory or a flatulent cause.

Warm fomentations, or young, vigorous, and sound animals, applied to the body, are extremely beneficial. **ARBUTH.** The patient should only be nourished with broths, in which gently detergent roots have been boiled. **BOËRH.**

It is a fatal error of some practitioners, when they find the body obstinately colicive, to give one purge after another; which not only exasperates the disease, but renders it mortal. Even the clysters should not be made of very stimulating ingredients; but of milk alone, with a little nitre; or rain-water, with syrup of violets; or of marsh-mallows, or roses solutive.

After

After bleeding and clysters, if the pain still continues violent, there will be no manner of danger in giving opiates, by which means the excruciating pain will be alleviated, the spasms appeased, and a breathing sweat will follow. When this is done, and the fever is abated, there will be no occasion to continue the diluting, relaxing, and moistening medicines, but rather the nervous and corroborating.

If the patient survives three days, and the acuteness of the pain abates, with a chiliness or shivering throughout the body, it is a sign of a suppuration: then within fourteen days the imposthume will break; and if it falls into the cavity of the abdomen, it will corrupt the whole mass of fluids, putrefy the viscera, and turn to an ascites; whence the patient will die of a consumption.

In this case, whey and chalybeate waters are likely to prove most beneficial.

If the fever continues, with clammy sweats, paleness, an ichorous diarrhoea, fetid, black, or like the washings of flesh, a small intermitting pulse, and at last a total cessation of pain; they are signs of a gangrene and an approaching death.

*Of the NEPHRITIS, or INFLAMMATION of the KIDNEYS.*

THE symptoms of a nephritis are, a great inflammatory, pungent, burning pain, in the place where the kidneys are situated, attended with a fever; the urine is made often, but small in quantity, and very red or flame-coloured, yet, in the highest degree of the disease, watry. There is a numbness of the thigh, and a pain in the groin and the testicle, of the same side; a pain in the ilium, bilious vomiting, and continual eructations.

When the inflammation is deep, the fever violent, the burning pain in the loins lasting, the difficulty of making water great, the body very costive, the anxiety and straitness of the præcordia exquisite, the urine crude and white; likewise if the pain continues till the fourteenth day, the kidney will suppurate; which is known from the abating of the pain, and from the thick purulent sediment of the urine. This will sometimes last several years, till there is nothing left of the kidney but a bag: It is attended with a hectic fever, and the patient before he dies is almost reduced to a skeleton. If the bag happens to burst, it brings on a retention of urine, and intolerable pains, which end in death.

If it continues beyond the seventh day, an abscess is to be feared, which is known to be forming by a remission of the pain, succeeded by a pulsation in the part, and chiliness and shivering often returning.

When the disease is favourable, it is cured by resolution, of a copious, red, and thick urine discharged at one time, or by a large flux of blood from the hæmorrhoidal veins, in the beginning of the disease.

It is cured by plentiful bleeding, revulsion and dilution; by soft, emollient, antiphlogistic decoctions.

When a burning and fixed pain in the loins continues for some time, it is a sign that the venal vessels are stuffed and obstructed with a thick blood, which requires immediate bleeding in the foot; or if there is a disposition to a hæmorrhoidal flux, apply leeches to the anus.

Afterwards give such things as temperate the heat of the blood, and promote a free circulation, with a diaphoresis. For which purpose, emulsions, demulcents, diluents, antispasmodics, diaphoretic powders, with cinnabar and nitre, are preferable to every thing else.

Emollient clysters, without any saline or purging stimulus, are the principal help in this disease. They may be made of milk, whey, or soft water, in which elder and chamomile flowers have been boiled; to which add an ounce or two of syrup of marshmallows, and a dram of nitre.

When there are convulsions, or excessive pain, opiates are proper. If the vomiting, a symptom of this disease, is too frequent, warm water sweetened with honey is beneficial.

The patient should avoid all acrimonious aliment; he should neither lie too hot, nor on his back.

When an abscess is formed, the medicines must be powerfully maturing and emollient: When the urine appears purulent, they must be diuretics of medicated waters, whey, and the like; together with balsamics.

Emulsions are likewise useful of the four cold seeds and sweet almonds. Some attribute a great virtue to cherry-tree gum dissolved in whey or water, and taken often. Also syrup of marshmallows is very useful. Add to these, the decoction of veronica, sweetened with honey, and mixed with powder of nutmegs.

Butter-milk, not very four, has been reckoned a great secret in ulcers of the kidneys; and chalybeate waters have been beneficial to some. Spruce-beer is a good balsamic in this case.

*Of the INFLAMMATION of the BLADDER.*

THE pathognomonic sort of this disease are, an acute, burning, pressing pain in the region of the pubes, attended with a fever, a continual tenesmus or desire of going to stool, and a perpetual striving to make water.

Other symptoms are, a rumbling of the bowels, griping pains, great anxiety of the præcordia, difficult breathing, want of appetite, vomiting, coldness of the extremities, a hard, quick, unequal, contracted pulse, inquietude, and sometimes convulsions.

There is another kind which is more superficial, and is either rheumatic or erysipelatous, in which the fever is more easily and speedily cured by promoting a diaphoresis: And persons in years, or who are affected with the scurvy, gout, rheumatism, or violent head-achs, are most subject to it; especially if they catch cold by being exposed to the rigour of a cold north-wind.

The former arises most commonly from the stoppage of the menses, bleeding piles, or other usual sanguinary evacuations; and not seldom from a violent gonorrhœa unskillfully suppressed by astringents, or when treated by medicines of too sharp and hot a nature.

This disease is mortal, if it terminates in an ulcer or mortification.

The cure must be attempted with bleeding in the feet, if a suppression of the menses or hæmorrhoidal flux be the cause.

If it proceeds from the scurvy, &c. recourse must be had to gentle diaphoretics, diluents, and remedies which obtund

obtain the acrimony of the humours, such as decoctions of the roots of scorzonera, china, skirrets, and fennel; also infusions, in the manner of tea, of the tops of yarrow, flowers of mallows, winter-cherries, and seed of daucus, made with milk, and sweetened with *syrup de althæa*. If the patient's body is costive, manna will be proper, with *nitrum sibiatum*; to which rhubarb may be joined, as occasion requires.

Externally, antispasmodics and gentle discutients will be proper: For this purpose apply bladders filled with a decoction of the emollient flowers.

If the tenesmus and difficulty of urine arise from spasms, there is nothing better than the vapours of a decoction in milk of the flowers of melilot, elder, chamomile and mallows, and the tops of yarrow. This decoction may be put into a close-stool; and the patient sit over it.

Tulpius informs us, that a desperate ulcer of the bladder was cured by the constant use of spaw-water.

#### *Of the OPTHALMIA, or INFLAMMATION of the EYES.*

AN inflammation of the membranes which invest the eye is a very common disease, especially of the adnata or albuginous coat of the eye.

The eyes are very much inflamed, with great pain, tension, tumour, heat, and redness; and sometimes there is such a strong sensation of pricking in the eye, as if it was caused by a needle or thorn. The eyes at first are full of scalding tears; which are followed by a pituitous matter, which is sometimes small in quantity, sometimes more plentiful: a *fordes* adheres to the greater angle of the eye; and when the disease is violent, the neighbouring parts will swell even as far as the cheeks, with a strong pulsation of the adjacent arteries. The small blood-vessels are visible, which in health are not to be seen, and all the white of the eye becomes red.

If, besides these external signs, there is an appearance of moths, dust, flies, &c. floating in the air, there is an inflammation of the retina.

As in all diseases of the eyes, so especially in their inflammation, the patient must abstain from all spirituous liquors, the smoke of tobacco and stercoratories; he must likewise avoid smoky rooms, and the vapours of onions and garlick, as also all vivid lights and glaring colours. The drink may be water alone, or a decoction of fennel-seeds, hartshorn, and barley; the aliment must be light of digestion.

Intemperance of all kinds renders persons liable to this disease; as also a keen north-wind, and looking earnestly at the fire, sun, or glaring colours: likewise smoky rooms, metallic vapours, costiveness, and unusual refrigerations of the extreme parts, especially in the time of menstruation. Sometimes it is owing to other diseases, as the small-pox, measles, scurvy, and the driving back the gouty matter.

A slight ophthalmia is easily cured; a more severe one generally continues a month or longer, and often leaves a spot in the cornea, or depraves the humours of the eye.

The slighter inflammations from dust or the sun are removed by fomenting with warm milk and water, and anointing the eyes with tutty ointment at night: if the eyes

are weak and but little inflamed, they may be washed with brandy and water.

In all cases we are to look narrowly and often into the inflamed eye; since the inflammation may be either begun or be kept up by moats, or by hairs of the cilia falling in, or growing inwards, so as to cause constant irritation.

Take away 10 ounces of blood, and the next morning give the common purging potion, which may be repeated twice or more, with the interposition of two days between each dose, and at night an ounce of diacodium.

On the days in which purging is omitted, let the patient take four ounces, three or four times in a day, of the emulsion of the four greater cold seeds, and white poppy seeds.

If the disease will not yield to repeated cathartics and bleeding, give an ounce of diacodium every night.

The slighter cases may be cured without bleeding; but if any degree of a fever is joined, or the inflammation is considerable, this evacuation is never to be omitted. The more violent inflammations are not to be cured without larger bleedings, unless we can make a derivation from the part affected without draining the whole body. For this purpose blisters are usefully applied behind the ears, especially if they are to lie on for two or three days, and if the sores are afterwards kept running. Two leeches should be applied to the lower part of the orbit, or near the external angle of the eye, and the wounds be allowed to ooze for some hours after they are fallen off.

This method will likewise do in ophthalmias from external injuries; but not when they proceed from a scrophulous or venereal cause. In bad cases, after the inflammation has yielded a little to evacuations, the coagulum aluminosum, spread on lint, and applied at bed-time, is the best external remedy.

In the mean while, blisters must be applied to the neck, and kept running for some days; and after that, setons, or issues at least. It is hard to say, of what vast advantage blisters and setons are in this disease.

The expressed juice of millepedes may also be given [25 are a dose] on the days purging is omitted, in four ounces of beer, or Rhenish or French white-wine: let them stand, when mixt, all night; and then take it with a little sugar in the morning, after the mixture is drained.

But according to the later experience of Dr Fordyce; Fothergill, and others, a strumous ophthalmia may be certainly and safely cured by half a dram of the bark given twice a-day.

The length of time in which the bark is to be taken is uncertain, for in some the cure is performed in less time than others.

Hoffman, besides blisters, setons, &c. recommends cupping, with scarification, in the nape of the neck, and behind the ears; and in the violent sort of this disease, bleeding in the jugular; as also sinapisms of rocket-seeds boiled in wine, and then put into small bags and applied to the nape of the neck or under the armpits. For inward use, he prefers to all other remedies, an infusion, in the manner of tea, of valerian-root, liquorice, elder-flowers and fennel-seeds, drank plentifully; and before  
the

the drinking of it to receive the vapour or steam into the eyes.

*Of the APOPLEXY.*

THIS disease is a sudden abolition of all the senses, external and internal, and off all voluntary motion, commonly attended with a strong pulse, laborious breathing, a deep sleep, and snoring.

There is no difference between a person asleep and in an apoplexy, but that the one can be awaked, and the other cannot.

The causes of this disease are a particular conformation of the body, as a short neck, for some have fewer vertebrae in their necks than others; a gross, plethoric, fat, phlegmatic constitution; polyous concretions in the carotid and vertebral arteries, or about the heart, &c within the skull, which are known by an unequal pulse, a vertigo; and sometimes a momentary loss of sight; an inflammatory thickness of the blood, preceded by a fever attended by the head ach, redness of the face and eyes, an advanced age, attended with a glutinous, cold, catarrhus, leucophlegmatic constitution.

The forerunners of an apoplexy in these last, are, dulness, inactivity, drowsiness, sleepiness, slowness of speech and in giving answers, vertigoes, tremblings, oppressions in sleep, night mares; weak, watery, and turbid eyes; pituitous vomiting, and laborious breathing on the least motion.

Other causes may be, whatever compresses the vessels of the brain; as, a plethora, a cacochymy, attended with fulness of the vessels; a hot constitution; tumors within the skull; the velocity of the blood increased towards the head, and diminished downwards; compression of the veins without the skull, which bring the blood back from the brain; the effusion of any fluid compressing the dura and pia mater externally; the effusion of any fluid within the brain, which by its pressure hurts the origin of the nerves; this is the most common cause of apoplexies, and proceeds from blood in the plethorical, from a sharp serum in the hydropical and leucophlegmatical, and from an atrabillious acrimony in the melancholic, the scorbutic, and the podagric. Violent passions of the mind, and intense study, are prejudicial to these.

There are three degrees of an apoplexy. The first is, when the vital fluids are, by the force of violent distensions, driven from the lower and outward parts of the body, to the external parts of the head, and to the brain and its meninges, by the carotid arteries; whereby their vessels are expanded, and the free circulation through them impeded. While this stagnation of the blood continues, the external and internal senses are abolished; and as the stoppage goes off they are gradually restored. Such are the fits that hypochondriacal and hysterical persons are subject to.

The second degree is, when the stagnation continues so long that the serum oozes through the vessels, and falls upon the sides of the medulla oblongata or spinalis, and so stops the influx of the nervous fluid, and produces a hemiplexia or a palsy.

The highest degree is, when the fine vessels of the pia

mater are broke, and the extravasated blood occupies the basis of the brain.

The first may be cured by timely bleeding: the second, though it does not suddenly kill, yet it generally renders the patient infirm ever after: the third is almost always mortal.

The immediate forerunners of an apoplexy, are: trembling, staggering, a giddiness in the head, a vertigo, dimness of sight, a stupor, sleepiness, forgetfulness, noise in the ears, more deep and laborious breathing, the nightmare.

A slight apoplexy goes off in a profuse, equal, roscid, warm sweat; a large quantity of thick urine, by the bleeding piles, the flowing of the menses, a diarrhoea, or a fever. If it is more severe, it usually terminates in a paralytic disorder; and is seldom curable, but always leaves behind it a great defect of memory, judgment, and motion.

Bleed in the arm to 12 ounces, and then in the jugular to 7 ounces; immediately after which, give an ounce and a half, or two ounces, of emetic wine.

Apply a large strong blister to the neck, hold the patient upright in bed, and let the spirit of sal ammoniac, highly rectified, be held to his nose.

Let there be strong frictions of the head, feet, and hands; and let the patient be carried upright backwards and forwards about the room, by two strong men. Strong blisters should be applied to the head, neck, back, and calves of the legs. Sharp clysters should be thrown up into the body, which have a tendency to excite the patient, and to cause a revulsion.

Shaw advises, during the fit, to bleed largely in the arm, or rather in the jugular, to apply strong volatiles to the nose, to blow sneezing powders up the nose, as also to rub the temples with spirituous cephalic mixtures.

Likewise to blow in the mouth and nostrils the smoke of tobacco from an inverted pipe.

Those who have once had a fit of the apoplexy, are very liable to be seized with it again; and if they are plethoric, the best preservative is bleeding once in three months, and using themselves to a spare diet; taking medicines which strengthen gently, and abstaining from cares and all intense applications of the mind; not neglecting issues and setons, nor the drinking suitable mineral waters.

*Of the PALSY.*

A PALSY is a lax immobility of any muscle, not to be overcome by the will of the patient. Sometimes the sensation of the part is absolutely abolished, and sometimes there remains a dull sense of feeling, with a kind of tingling therein.

It may be caused by all things that bring on an apoplexy; that render the nerves unfit to transmit the animal spirits; that hinder the entrance of the arterial blood into the muscle. Hence the nature of a paraplegia or hemiplegia, and the palsy of a particular part, may be understood.

Hence a palsy may proceed from an apoplexy, an epilepsy, extreme and lasting pains, suppressions of the usual

evacuations, translations of the morbid matter in acute distempers; whatever distends, distorts, compresses or contracts the nerves, strong ligatures, luxations, fractures, wounds, gangrenes, inflammatory and other tumors of the coats of the nerves, in the ganglia, or the nerves themselves; extreme heat, violent cold, mineral effluvia, and the too frequent use of hot water.

Palsies of the heart, lungs, and muscles serving for respiration, are soon fatal; of the stomach, bowels and bladder, from internal causes, very dangerous; of the face is bad, and easily changes to an apoplexy.

If the part is cold, insensible, and wastes away, it seldom admits a cure; if attended with a violent convulsion and great heat of the opposite part, it is very bad.

The regimen in this disease ought to be warm and attenuating, consisting of spicy and cephalic vegetables, such as create a feverish heat, because it is necessary to dispel the viscosity. Soapy vegetables are best, and such as consist of an acrid volatile salt, and oil, mustard, horse radish, &c. stimulating by vomits; sneezing; relaxing the belly; promoting sweat by such motions as can be used, or other means; by strong friction, &c.

The cure of the palsy is to be attempted by attenuants and discutients; such as, aromatic, cephalic, nervous and uterine vegetables; their fixed and volatile salts; as also by their oils; soaps made of their oils and salts; the strong scented parts of animals; the juices, spirits, oils, and tinctures of insects; fossile salts, metallic crystals, and medicines compounded of these.

Likewise by things which stimulate strongly, and which, by exciting a tremulous and convulsive motion of the nerves, drive out the impacted matter; to this class, sternutatories and emetics chiefly belong, especially if often used at first.

By purging with warm, opening, aromatic vegetables, with acrid fossils, with mercurial and antimonial preparations, in a large dose, and repeated successively for several days, by the means of which a copious and lasting diarrhoea may be excited.

By filling the vessels of the body with drinking a large quantity of the attenuants above mentioned, and then by exciting a greater motion and sweat by the vapours of spirits set on fire.

Outwardly, frictions may be used, either dry and hot, till the part is red; or with spirits endued with a stimulating virtue; or with nervous oils, liniments, balsams, or ointments; vapour or immerse baths; acrid, aromatic, and drawing plaisters; cupping, scarifications, blisters; whipping the part with rods; exciting a slight inflammation with nettles, and the like.

A course of electrification for some weeks has been known to have cured some inveterate palsies, though it hath failed in others. See ELECTRICITY.

#### *Of the EPILEPSY, or FALLING SICKNESS.*

SOMETIMES this disease comes on suddenly and unawares; but it oftner gives notice of its accession by some preceding symptoms; the chief of which are, a lassitude of the whole body, a heavy pain of the head with some disturbance of the senses, unquiet sleep, unusual dread, dimness of sight, a noise in the ears: in some there is a

violent palpitation of the heart, a puffing or inflammation of the præcordia, a stopping of respiration, a murmuring noise in the belly, fœtid stools, a flux of urine, a refrigeration of the joints: in others, there is a sense, as it were, of a cold air ascending from the extreme parts to the heart and brain.

Then they fall suddenly on the ground, (whence the name of the falling sickness;) the thumbs are shut up close in the palms of the hands, and are with difficulty taken out; the eyes are distorted or inverted, so as nothing but the whites appear; all sensation is suspended, inasmuch that by no smell, no noise, nor even by pinching the body, can they be brought to themselves; they froth at the mouth with a hissing kind of a noise, the tongue is lacerated by the teeth, and there is a shaking or trembling of the joints.

However, the convulsions vary, as well as the defect of the senses, both in degree and kind; for sometimes, instead of convulsive motions, the limbs are all stiff, and the patient is as immovable as a statue. In infants the penis is erected; in young men there is an emission of semen, and the urine very often streams out to a great distance.

At length there is a remission of the symptoms, and the patients come to themselves after a longer or shorter interval; then they complain of a pain, torpor and heaviness of the head, and a lassitude of all their joints.

These fits are more frequent or seldom, or longer or shorter, according to their different causes. Some return on certain days or hours, or even months, according to the quadratures of the moon, but especially about the new or full moon; in women, chiefly about the time of menstruation; and what is most remarkable, often upon a very slight occasion; for instance, any sudden perturbation of the mind, as a fright, anger, sudden joy, intense application, strong liquors, excessive heat or cold, or venereal exercises.

As to the prognostics; in boys, this disease terminates about the seventh, the fourteenth, or the seventeenth year, that is, about the time of puberty; in women, about the fourteenth, *viz.* the time of menstruation. Likewise it has been found by experience, that chronic epilepsies have spontaneously ceased by the change of place, diet, and way of life. Sometimes a quartan ague will put an end to an epilepsy and convulsion-fits. It is also remarkable, that the itch, or any other cutaneous distemper, such as the small pox, measles, military eruptions, &c. will either abate the violence, or quite stifle this disease.

The patient therefore need not despair of a cure, if the disease is not of long standing, the fits short, the disorder not hereditary, and the years advancing to the time of puberty; or if it proceeds from a fault in the *primæ viæ*, from worms, from a bad regimen, or from a subcutaneous disease ill cured. Nor is the case desperate if the epilepsy be slight, and when the fit is foreseen by a sensation of cold air, arising from the extreme parts to the back, præcordia, and head, and also when it is ushered in by anxiety, by want of strength, and a propensity to vomit; or when the senses are not quite abolished in the time of the fit, or when it comes on in the night, without the incurvation of the thumbs.

It is a bad sign if the epilepsy makes its first attack after the twenty first year, but much worse if the fits grow more frequent; for then the animal functions are often destroyed, and not only the memory, wit, and judgment are impaired, but the patient grows stupid and foolish. It sometimes ends in melancholy or madness. When it turns to a palsy or apoplexy, it is mortal.

The epilepsy is extremely difficult to be cured in adults, but in children it is the reverse. Blisters laid to the back part of the head are of great use a little before the paroxysm is expected: and the time may more certainly be foreknown, as this disease is influenced by the moon, and attends upon its phases, especially the new or full moon. The most proper medicines to correct the juices seem to be native cinnabar, and wild valerian root; a dram of which may be given morning and evening for three or four months, and afterwards two or three days before the new and full.

However, it must not be forgot, that this disease owes its origin to so many different causes, and is bred in so many different constitutions of the body, and the same remedy which succeeds in one case often fails in another; and therefore different medicines are to be tried, especially on adults. And great regard must be had to the times in which the paroxysms usually return, in order to effect a cure.

If the vessels are full of blood, or it is carried with too great an impetuosity towards the head, then bleeding in the ankles will be proper, or leeches applied to the hæmorrhoidal veins. This often happens to hypochondriacal or hysterical persons, to the melancholic, and women with child. Sometimes it will be proper to bleed in the jugulars; or to apply cupping-glasses with scarifications to the neck, and parts near the head.

It has its origin from a sharp, impure serum in the head, or in the membranes and vessels, as in cachectical or scorbutical persons, or those who have been inconsiderately cured of œdematous swellings of the feet, old ulcers, or issues dried up; the driving in of the itch, scabs, or the ulcerating humour of a scald head; then the cure may be attempted by cathartics, by purifiers of the blood, by evacuating the impure humours with setons, issues, cauteries, and blisters.

If it proceeds from violent pain, as for instance, from a stone sticking in the ureter, from the tooth-ach, ear-ach, or spasms of the stomach and bowels; then clysters of oil of sweet almonds, or the like, are to be administered.

If, in children, it proceeds from gripes, or the breeding of teeth, nothing is better than to cleanse the *primæ viæ* from slith, by milk-clysters, with a little venice-soap dissolved in them.

If from worms, after antiseptics and soft oily things, anthelmintics must be given, such as tansey, garlick, camphor, asa fetida, worm-seed, mercurius dulcis, and ethiops mineral, or powder of tin.

When the fits return at certain periods, or at the quadratures of the moon, a clyster or a vomit will be proper first of all, of half a dram of ipecuanha, in a decoction of raisins.

In the time of the fits, too free a use of volatiles,

spiritous liquors, and strong smells, are hurtful, as causing the humours to flow too much to the head: The best method is to place the patient in an erect posture, and to rub the hands and feet pretty briskly.

The best drink is water, which will mitigate, if not cure the symptoms.

When the patient is so happy as to foresee the accession of the fit, then let him have immediate recourse to clysters and frictions of the lower parts.

A milk-diet alone has cured an inveterate epilepsy. Mistleto is said to cure an epilepsy as sure as the bark an intermitting fever. The dose to grown persons is half a dram or more, in powder, every sixth hour, drinking after it a draught of a strong infusion of the same plant. If to every ounce of the powder, a dram of asa-fetida be added, the medicine will be still more effectual.

Cinnabar of antimony is greatly celebrated for the cure of this disease; and may be taken from four grains to a scruple, in conserve of rosemary flowers.

Ferreus and Jachinus affirm, they have cured many epilepsies with a simple decoction of guaiacum, giving six or eight ounces of it twice a-day, and the secondary decoction of the same for their ordinary drink. This decoction should be continued 30 or 40 days, to which may be added male piony root, or something of the same kind; and every dose may have a few drops of the spirit of vitriol added thereto.

After all, there is no medicine that can be depended more upon than MUSK; for it is an excellent remedy in all diseases of the nerves, particularly cramps, convulsions, vertigoes, and epilepsies. Ten grains may be taken morning and night, made up into a bolus; if the same quantity of factitious cinnabar be added to each dose, it will not be the worse.

#### *Of St VITUS'S DANCE, and other convulsive disorders.*

St Vitus's dance is a sort of a convulsion, which boys and girls are sometimes subject to, from the age of ten years, to the time of puberty. It discovers itself first by a kind of lameness, or an instability of one of the legs, which they draw after them in a ridiculous manner, nor can they hold the arm of the same side still for a moment; for if they lay it on their breast, or any other part of their body, it is presently forced away from thence by a convulsive motion. If they are desirous of drinking, before they can bring the cup to their mouth, they use a thousand odd gesticulations like a mountebank; for they cannot bring their hand in a direct line to their mouth, but it is forced this way and that, till at length, if they have the good fortune to hit the mark, they throw the liquor down their throat as greedily as if they designed to raise laughter in the spectators.

In a convulsive paroxysm, the limbs are strangely agitated with various different postures and motions. Sometimes the hands are put behind them as if they designed to sit upon them, and soon after they seem to be beating the air; then their legs will be drawn hither and thither as if they were dancing some antic dance. Sometimes they will bend their backs like a bow, at the same time raising their breast as high as they can; then their whole body will grow stiff, and as immoveable as a stone. They generally

generally keep on their legs without falling; yet some will grovel on the earth like epileptic persons, and will weep, laugh, gnash their teeth, gape with their mouths, put out their tongues, roll their eyes, and whirl their heads about in a strange manner.

After the fit, some are inexpressibly weak; some faint away, others fall into a deep sleep; in others, again, the fit is terminated with eructations, wind, vomiting, and throwing out plenty of water. Very often a mucus discharges from the nose, or blood issues from thence, or from the uterus or hæmorrhoidal veins.

These persons have generally unquiet sleep, and full of dread and terror, an uncertain appetite, their bodies generally a little costive; they sweat with difficulty, but are subject to great passions of the mind. The accessions of the fits keep exact pace with the phases of the moon. In women they precede or accompany the eruption of the menses. They are most frequent and worst after meals; and are easily excited by the passions of the mind.

The fits are generally preceded with a coldness of the feet and limbs, or a kind of tingling sensation; which also affects the os coccygis, and like cold air ascends up the spinal marrow; there is a distended flatulent pain in the left hypochondrium, and such a constipation of the body that neither wind nor excrements can make their exit, nor will the anus admit a clyster-pipe, or, if it does, the clyster and excrements are thrown up by vomit. The bladder is likewise so affected, that no urine can be made, or at least but little, and thin and white. In others, the accession begins with yawning, stretching, anxiety about the heart; a hard unequal contracted pulse, the heart-burn, nausea, vomiting, palpitations of the heart, difficulty of swallowing, pain of the head and teeth, noise in the ears, giddiness, &c. and then come on the convulsions.

Though this is a terrible disease, it never kills suddenly. When it is recent, the person young, and otherwise of a good constitution, there is the greatest hopes of a speedy cure. If usual evacuations of blood by the uterus or hæmorrhoids are suppressed, the return will either mitigate or cure the disease. On the contrary, if the humours are thick and impure, the suppression obstinate, their temperament inclining to great sensibility, the age advanced, or the disease hereditary, or become habitual, the cure is difficult. Sometimes, through ill management, it degenerates into an epilepsy or hypochondriac melancholy.

To cure the St. Virus's dance, take away about 8 ounces of blood, more or less, according to the age of the patient; the next day give half, or something more of the common purging potion according to the age, and in the evening the following draught:

Take an ounce and a half of alexeterial water; 30 drops of compound spirit of lavender; a scruple of theriaca andromachi; and 8 drops of the tinctura thebaica. Mix and make them into a draught.

Let the cathartic potion be repeated thrice every other day, and the same draught in the evening. After which, bleed again, and repeat the cathartics three or four times; and this course may be pursued to the third or fourth time.

Apply to the soles of the feet *emplastrum e caranna*.

For fear of a relapse, at the same season of the next year, or a little sooner, in which the distemper appeared, bleeding should be again repeated, and purging two or three times.

Allen cured two girls of this distemper with the express of millipepes and the Peruvian bark, after bleeding and a gentle cathartic.

As to the cure of other convulsive disorders, if the patient is plethoric, or the pulse great, it must be begun with bleeding either in the arm or foot; and if occasion require, it must be repeated two or three times, but not till the fit is over. The air should be dry and serene, with constant exercise; the aliment should be easy of digestion, and all hot spirituous liquors should be avoided. The constant drink should be the decoction of scorzonera roots, with shavings of hartshorn, or whey, or the Selter's mineral waters. *Pediluvia* are likewise proper, of river-water, wheat-bran, and chamomile-flowers. They should be used pretty warm and deep, at the time of going to bed, and afterwards sweating should be promoted.

The patient's body, if costive, must be kept open with manna, or with oily clysters; and if the *fomes* of the disease is judged to be in the *prima via*, it will be proper, at the changes of the moon, to give a vomit with manna, that is, an ounce of manna with two or three grains of tartar emetic.

If, about the time of puberty, this disease proceeds from too early or excessive coition, or violent passions of the mind, all things which cause a commotion in the fluids must be avoided; such as, aromatics, sharp purges, emetics, spirituous liquors, inordinate motions of the body or mind, and all heating things in general. On the contrary, the diet should be soft, emollient, and nourishing; such as cow's or ass's milk, or whey; as also baths of sweet water mixed with milk. Likewise jellies, and decoctions of scorzonera, barley, hartshorn, ivory shavings, and viper's flesh, for ordinary drink, and chocolate.

If it proceeds from worms, the cure depends on their being killed and expelled out of the body: But all anthelmintics, or worm medicines, are not to be made use of in this case; such as garlick, vitriol, copper, aloes, sharp purges, and mercurials; because, if they are given inconsiderately, they are hurtful to the nerves. It will be better to use clysters, made of milk, sweet things, and oil; as also liniments of a purging quality applied to the navel and abdomen. Inwardly may be taken *semen santonici*. If *mercurius dulcis* is given with a cathartic, it will be necessary first of all to let the patient take a few spoonfuls of oil of sweet almonds.

If it is caused by a suppression of the menses, emmenagogues and hot medicines are to be forborne; but bath-waters and bleeding will be proper; as also *pediluvia*, if made pretty warm; hot infusions of balm flowers, and flowers of the lime-tree, tincture of castor, absorbent powders, antispasmodics, and anodynes.

If from a stoppage of the hæmorrhoidal flux, besides bleeding and the above remedies, leeches applied to the anus will be of very great advantage.

In the observations of the medical society of London, we have an account of a deplorable convulsive case being cured by electricity.

*Of the CONVULSIVE ASTHMA.*

AN asthma is an impeded and very laborious respiration, attended with unspeakable anxiety, and a straitness about the præcordia, hindering the free circulation of the blood through the lungs, arising from variety of causes, and not without danger of suffocation.

There are several sorts of asthmas. One is, difficulty of breathing, proceeding from corpulency and a very full habit of body; and is most apparent after violent motion: but this is a slight disorder, and free from all danger. The next is the pituitous asthma, attended with a moist cough, and the bringing up pituitous matter; it attacks the patient at all hours, and in all positions of the body, and is owing to a plenty of a viscid mucus, stuffing the vesiculae of the lungs, and hindering the free ingress and egress of the air through them. Another is owing to the convulsive contraction of the parts designed for respiration, and proceeds from various causes both within and without the thorax; and this is called the dry flatulent or convulsive asthma.

There is a heaviness of the breast, a slowness to perform customary labours, difficult breathing when going up a hill; the patients grow hoarse, cough, and are troubled with frequent eructations; they cannot sleep, and are scarcely warm in their beds. As the disease grows worse, the cheeks look red, the eyes grow prominent as if they were strangled; they snore or wheeze while waking, but much more when asleep; they are fond of cold air, they keep themselves in an erect posture and seem to suck in the air with open mouth: they are troubled with sweating about the neck and forehead; then comes on a violent cough, and the patient brings up a little cold frothy matter. As they draw in their breath, the neck swells, and the præcordia are pulled upwards; the pulse is small and quick. If it increases, the patient is in danger of suffocation: but if it grows better, the fits are seldom, and greater plenty of matter is coughed up; the urine is more plentiful, but without a sediment; the voice grows clearer, the sleeps longer than are necessary, the præcordia are set at liberty; a pain sometimes passes to the shoulders; the breathing is slow and gentle, but with a sort of a wheezing.

The longer this disease continues, the more sharp and violent all the symptoms become. The patient's body grows more costive, and the urine is thin and watry; most commonly the feet swell, then the hands, face and back; there is a numbness of the arms, the countenance is wan and livid, or of a leaden colour. Then comes on a little fever, which grows worse in the evening; the whole body is cachectic, with an œdematous swelling of the feet; there is a dropsy of the breast, or an ascites, or anasarca; at least there is a palsy on one side, or of the arm; or, instead, thereof a palsy of the eyelids.

When the disease is recent, and is owing only to the spasmodic contraction of the præcordia, there are hopes of a cure; especially if the matter of the gout, ulcers, and exanthemata, are sent back to their proper seats. When the menfes or hæmorrhoids which were stopped return, it yields relief, and, if the disease was not too far advanced, perfect health. If it is inveterate, or ill ma-

naged, it brings on a dropsy of the breast, obstructions of the lower belly, œdematous swellings of the feet, a cachexy, and an universal dropsy. In general, all convulsive asthmas portend a sudden exit, or suffocation, especially if there is a polypos of the heart; if it continues long, then the patient will die of the dropsy; in which case it will be soon fatal; when there is a slow fever, an unequal intermitting pulse, a palsy of the arms, a continual palpitation of the heart, little urine, a syncope or swooning, then death is at hand. Some are carried off by an inflammation of the lungs, and the more grievous the disease the more languid the pulse. The asthma, in old persons, continues till death.

In the paroxysm, because the body is generally bound, and the wind and humours are carried upwards, the speediest assistance is from emollient and carminative clysters.

Afterwards use frictions of the feet, which have an incredible efficacy; also let them be put into warm water; for the feet are almost always cold. When there is a violent spasm about the præcordia, hot fomentations are necessary, or bladders filled with hot milk, and applied to the part affected; likewise nervous liniments are very useful, rubbed in with a warm hand.

Internally, antispasmodics should be given, with gentle diaphoretics

And this is all that needs to be administered in the fit.

Out of the fit, if it proceeds from too great a congestion of blood about the breast, or from a polypos of the heart, bleeding in the foot will be proper, as also scarifications; in a suppression of the hæmorrhoids, leeches should be applied to the anus; also gentle laxatives to cleanse the *prima via*; likewise bodily motion, slender diet, and soft drink. If there are hypochondriacal or flatulent symptoms, then gentle laxatives will be the more necessary, together with clysters. When the menfes or hæmorrhoids are suppressed, nothing is better than the bath-waters, both for bathing and drinking; or the waters of Selters taken warm and mixed with milk.

When the asthma proceeds from the driving back some impure matter from the skin, or from the drying up of ulcers, and the humour is translated to the nervous parts of the breast, then gentle diaphoretics will be necessary to send it back to the superficies of the body.

After which the patient may drink tea made of balm, or elder, or lime tree-flowers, with the leaves of scordium, or veronica and fennel seeds, or any thing else of the same kind. Remedies compounded of sulphur are likewise very efficacious in driving back the morbific matter to the skin, though outwardly they are hurtful in cutaneous diseases.

The returns of the fits are to be observed and guarded against, by moderate evacuations, as bleeding, gentle vomits, laxatives, and sometimes cathartics: but every thing that heats the blood should be carefully avoided, especially about the usual times of the paroxysms; because there is generally then a lurking fever, which ought not to be exasperated by heating food or medicines.

In a dry asthma proceeding from fumes of lead, an air-replete with exhalations from quick-lime, or the vapours of pitcoal; milk, cream, oil of sweet almonds, emulsions



of sperma ceti, the fat of animals used internally and externally, answer every purpose.

Country air, and following the plough, are beneficial to restore the debilitated tone of the lungs; and tea, made with hyssop, veronica, ground ivy, liquorice, and daisy flowers, cannot be enough commended. But sweet things, in every kind of asthma, are hurtful, especially in the humid or serous, and the hypochondriacal.

#### *Of a COUGH.*

THE cough now under consideration is a primary disease, which greatly disorders the whole body by its vehemence and obstinacy. Its cause is, a flux of serous humours from the outward parts and extremities of the body to the lungs, and is seldom without feverish heats and shiverings towards the evening.

It is either moist or dry: the former afflicts the phlegmatic, whose fibres are lax and muscles soft, and who abound with serous and pituitous humours. Women are more liable to it than men; as also infants, boys, and old men, more than those in the vigour of their age. The dry cough principally attacks the hypochondriac, the scorbutic, the cachectic, and those who are lean and slender, and subject to convulsive disorders, and whose bodies likewise abound with a sharp serum.

The most violent of these kind of coughs is the *tussis convulsiva*, or *serina*, whose effects are so violent as almost to put the patient in danger of suffocation: In children, this is called the hooping cough. Sometimes this is dry in the beginning; or the patient brings up a little thin serum, more or less sharp. Sometimes it is moist; and then after a very laborious fit, the patient expectorates a sublimid, and commonly a most tough mucus. The extreme parts grow cold, the body is costive, the urine and the vital fluids are driven in greater plenty and force towards the breast and head; so that while the paroxysm lasts, the face is red and turgid with blood, the veins swell, the arteries beat quicker and stronger, the eyes are ready to start out of the head, the tears flow, the eyelids swell, and sometimes the blood, after sneezing, springs from the nose. Sometimes the very vessels of the lungs burst, and a spitting of blood ensues. Sometimes a hiccup supervenes, and then at the same time the patient is affected with laborious vomiting; some discharge their excrements and urine insensibly; and the coughing of others is so violent as to cause ruptures, especially in children.

As to the prognostics, a dry cough often turns to a moist, by hurting the digestion, and rendering the patient cachectic. When a moist cough becomes suddenly dry, and the breast remains oppressed, we may conclude that a putrid or hectic fever, or an exulceration of the lungs, are near at hand. In the convulsive cough of children there is danger of a suffocation; which cough sometimes happens in difficult dentition, and in the measles. It sometimes causes gibbosity and ruptures in boys; in women abortion; in adults a spitting of blood and a phthisis. Coughs that proceed from a schirrus of the lungs or other viscera, are incurable; if from driving in of exanthemata, or breakings out of the skin, it grows easy as soon as they are thrown out again. All coughs attended with loss of sleep are bad; as also that which is

frequent, tedious, obstinate, and proceeds from a defluxion on the lungs. On the contrary, a moderate heat in the night time, with an equal breathing sweat throughout the whole body, a larger flux of urine, and the body open at the same time, a more quiet sleep, and an easier expectoration, are certain signs that the disorder is going off.

If the cough is recent, and there is no fever, nor other signs of a bastard peripneumony; or if it is not the consequence of a pleurisy or a peripneumony ill cured, by a neglect of sufficient bleeding; the patient need only abstain from wine and flesh for some days, and use the following remedy.

1. Take 10 drops of balsam of sulphur, with a bit of candied sugar; to be used twice or thrice in the day.

Recent coughs, after bleeding, are softened by a mucilage of linseed, or by any common sweet oil: But the oils are made more efficacious by the addition of a volatile alkaline salt, in this manner:

2. Take an ounce and a half of oil of olives, 6 ounces of water, 60 drops of spirit of hartshorn, an ounce of pectoral syrup: Take three or four spoonfuls every fourth hour.

If the cough will not yield to these remedies, then it will be to no purpose to rely on pectorals, especially if there is a fever along with it, or if it proceeds from a pleurisy or peripneumony; for then it is to be cured by bleeding and purging, in the same manner as the bastard peripneumony.

When there is a thin, salt, sharp defluxion, jellies are proper, and a decoction made of barley, shavings of hartshorn, viper-grass root, and liquorice; or the decoction of turpentine with sugar; and above all things, oil of sweet almonds fresh drawn.

When a *tussis catarrhalis* affects the whole habit or body, with a loss of appetite and a tabes, the cure must be attempted with asses milk or whey, or milk with equal parts of Selters waters, and especially riding.

In a moist, lasting, pituitous cough, the body must be kept open with manna, two ounces at least dissolved in any convenient vehicle, to which may be added, two drams of terra foliata tartari, and a few drops of oil of aniseed. If the stomach will not bear laxatives, clysters must be used.

When the cough is outrageous, saffron mixed with bezoardics is very friendly to the breast; nor are storax pills, mixed with the aromatic pills, less beneficial. You may order about 6 grains of the storax pills, with a scruple of the aromatic, and give them at bed-time; in the mean while not neglecting the expectorants, oil of sweet almonds, and sperma ceti. Likewise the thebaic tincture mixt with spirit of hartshorn is not unuseful for the same purpose.

But the best opiate in this case, is the elixir paregoricum: the dose for children is from 5 to 20 drops; for adults, from 20 to 100 and upwards. It is peculiarly excellent for children in the hooping-cough or chin-cough.

The patient should, as much as possible, breathe a temperate air, shunning all salted and smok dried meats,  
poignant

poignant sauces, for they render the blood and serum sharp and impure; he should also abstain from malt liquors, but more especially acid wines. The drink should be hydromel; or, if the patient is scorbutic, water alone, the cold being first taken off with toasted bread. The vulgar pour hot water upon wheat bran, and drink the infusion cold, not without success.

As to bleeding in this disease, it is necessary for those who are full of blood, and whose veins are very prominent; or when the usual excretions of it are suppressed; it is also a good preservative, though the person has past his seventieth year. Blisters may likewise be used, in obstinate cases.

*Of a PHTHISIS, or Consumption of the LUNGS.*

If an ulcer of the lungs consumes them so far that the whole habit of body wastes away, it is called a consumption of the lungs.

This ulcer may proceed from any case which may detain the blood in the lungs so as to change it into a purulent matter.

The causes may be referred.

I. To that temperament of the body which tends first to spitting of blood, then to an ulcer of the part where the blood has made its way through. This consists,

In a tenderness of the arterial vessels, and in the impetus of a more or less acrimonious blood. This is known from a view of the tender and fine vessels, and of the slender make of the whole body, a long neck, a flat and narrow thorax, depressed scapulæ; the blood of a bright red, thin, sharp, and hot; the skin transparent, very white and fair, with a blooming red in the cheeks; the wit quick, subtle, and early ripe with regard to the age, and a merry cheerful disposition.

In such a debility of the viscera as disposes their too tenacious contents to produce obstructions, putrefactions, and to grow acrimonious, whereby the vessels are corroded, first causing spitting of blood, and then ulcers. This is discovered by a slight febricula, a little dry cough, an unusual heat, a redness of the lips and mouth, a flushing in the face; which are most apparent when the new chyle enters into the blood; a propensity to sweating when asleep, a weakness, a shortness of breath increasing upon the least motion,

In that age when the vessels have attained their full growth, and will not admit of any further lengthening; when at the same time the blood increases in quantity, acrimony, and force; which happens between the sixteenth and thirty-sixth year of the patient's age.

In an hereditary disposition to this disease.

These dispositions to a phthisis are hastened,

By a suppression of accustomary evacuations, especially the sanguineus; as the hæmorrhoids, menses, lochia, bleeding at the nose, usual blood-letting, chiefly in the plethoric, and those who have lost a limb.

By any violent shock of the lungs, by coughing, shouting, singing, running, violent efforts of the body, anger, and wounds.

By sharp, saline, aromatic aliment, or drink; by the particular manner of living; by another disease, whence the quantity, acrimony, velocity, rarefaction and heat of

the blood are increased. Hence it frequently happens from acute fevers, the plague, small-pox, and scurvy.

II. Likewise this collection of pus may proceed from a peripneumony, which terminates in an apostem.

III. When there is an empyema formed, it may corrode, destroy, and consume the lungs, and so produce the same disease as if they were wasted away by an ulcer generated in their own substance

The sign of an approaching phthisis is a dry cough, which may continue for some months; whereas a simple catarrh is attended with spitting, and is but of short duration. Vomiting, or a disposition to vomit after eating, excited by the above mentioned cough, is a most certain sign of a phthisis.

It invades persons from eighteen to thirty-five years of age; the whole body wastes away. There is a hectic fever, which is most apparent after meals, and is known by the quickness of the pulse, and the redness or flushing of the cheeks: The matter brought up by the cough is bloody or purulent; if it is spit into the fire, it yields an offensive smell; if into a vessel of water, it falls to the bottom. Though it is thick, it is not glutinous or tenacious, but fluid, and of different colours, viz. yellow, green, but most commonly of an ash-colour.

This disease begins with a slight pain, moderate heat, and an uneasy or oppressive tightness of the breast. When blood is brought up by coughing, it is generally of a florid, scarlet colour, and frothy, and proceeds from the lungs with a remarkable noise. It is mixt with fibres, films, and small portions of arterial, venal, and bronchial vessels: The pulse is soft, small, and undulating; the breathing is difficult; and these symptoms are preceded by a saltish taste in the mouth.

Blood is coughed up from the lungs sometimes without any pain; and if there is a vessel broken, it most commonly flows out in a great quantity at the first eruption, and afterwards more sparingly.

Spitting of blood is cured by copious bleeding every third day, to the fourth time, or till the inflammatory pellicle entirely disappears. Sydenham advises the taking away 10 ounces of blood, to take the common purging potion the next morning, and at night an ounce of diacodium. Hoffman likewise advises gentle purging and pediluvia, as also putting the hands into warm water. For appeasing the orgasm of the blood, he thinks nothing better than spirit of vitriol, but more especially the tincture of roses acidulated therewith. Morton very judiciously prefers the Peruvian bark. Refrigerating, thickening, styptic lenient remedies, used a considerable time, are serviceable, with which may now and then be mixed the most lenient balsamics.

Hoffman advises the following powder, as preferable to every thing else, in appeasing the spasmodic strictures of the lungs.

1. Take seeds of white henbane, and crabs eyes, of each a dram; 12 grains of nitre; and one grain of camphor. Make them into a powder.

A prudent use of the nonnaturals is likewise necessary, that may best oppose the cause of the disease; and chiefly a proper aliment, and manner of living; a milk-diet is preferable to any other.

When

When the cure is performed, it will be necessary, by way of prevention, to bleed once in six months, for several years together.

But if, by reason of the violence of the disorder, or the unskilful use of (typtics, there should, after the spitting of blood, arise a difficulty of breathing, which continually increases, a wandering shivering heat and redness of the cheeks, a dry husky cough, a slight hectic fever, a preternatural thirst, a weakness, or sense of weight in the breast, it is a sign that the wound from whence the blood flowed has already begun to change to matter about its lips. Then under the crust of dried blood *pus* is formed; and this collection degenerates into a latent *VOMICIA*; and that being broken, becomes an open ulcer of the lungs.

The effects of an ulcer of the lungs thus formed, are generally these which follow: An increase of the acrimony and quantity of the putrid *pus*, a dilatation and corroding maceration of the membrane or bag in which it is contained; a conversion of the blood-vessels and the bronchia into *pus*; a purulent consumption of the whole lungs, or of one of its lobes; a continual dry cough, or spittle thook off by the constant concussions of the cough; a conversion of the blood flowing into the ulcer into *pus*; an increase of the vomica in the lungs; the bursting of this vomica into the tube of the larynx; the sometimes suffocating discharge of the *pus*, or the daily coughing up of matter, which sinks in water, and is thick, sweet, fat, fetid, white, red, yellow, livid, ash-coloured, or streaked, and which, put into the fire, has the smell of burnt flesh. Sometimes the vomica breaks into the cavity of the thorax; from whence proceeds difficulty of breathing, and the other symptoms of an empyema. Then the respiration grows exceeding bad; the chyle and the whole mass of blood are converted into *pus*; the usual method of nourishment is destroyed, the solids continually consume and waste away; a hectic fever appears, with a small languid pulse, and the heat in the upper parts intense, the cheeks look red, and the face hippocratic. Generally there is an inexpressible anxiety towards the evening; an unusual thirst; profuse nocturnal sweats; red pustules; a swelling of the feet or hands on the side affected; excessive weakness; a hoarse voice; a falling off of the hair; an itching throughout the body, with watery pustules; a debilitating diarrhoea, with yellow, fetid, purulent, cadaverous stools; a suppression of the spitting; and then death.

Hence the following prognostics may be formed.

An hereditary phthisis is the most dangerous of all, and is incurable unless the spitting of blood be prevented. A phthisis from external violence, that is, proceeding from spitting of blood caused thereby, is the slightest of all.

A phthisis in which the vomica breaks suddenly, and the patient easily brings up a white, concocted, smooth *pus*, and in quantity proportionable to the ulcer, without thirst, and with a good appetite and digestion, due secretions and excretions, is curable, though with difficulty.

Heavy, solid, stinking, sweet spittle, with night-sweats, livid cheeks, paleness of the face, the nostrils pinched up, sinking in the temples, incurvation of the nails, falling off

of the hair, and a colliquative diarrhoea, are signs of approaching death.

When a vomica is known to be formed in the lungs, then the physician must endeavour to ripen and break it; which is to be done by milk-diet, riding on horseback, warm vapours and expectorants: Which done,

1. The blood must be guarded and defended against the purulent infection, by remedies which are moderately and agreeably acid and salish, by vulnerary herbs, smooth balsamics given in various forms, in great plenty, and continued a long time.

2. The ulcer must be cleared as soon as possible from the purulent matter, the lips of it cleansed and consolidated, which is to be done by liquid medicines, by things which promote coughing, by motion, riding, country-air; these are expellents. The cleansers are detergent balsamics, used inwardly and outwardly. The consolidators are paregorics.

3. The aliment must be such as requires the least force to make it pass freely through the lungs, and be there assimilated, and at the same time be fit for nourishment. Asses milk is very suitable to this intention, as also buttermilk.

Small repeated bleedings are not only beneficial in old coughs, threatening consumptions, but also after purulent spitting and hectic symptoms have appeared. The quantity of blood to be drawn is from four to seven or eight ounces, once in eight or ten days.

Setons, or issues made in the side of the part that is most affected, are very beneficial.

We must endeavour to diminish the defluxion on the lungs, by bleeding and gentle purging, as well as pectorals, accommodated to the various states of the distemper, *viz.* by thickening medicines and attenuants, and such as temperate the hectic fever, with emulsions and asses milk, &c. and lastly, by healing the ulcer with balsamics, as opobalsamum; the dose is 20 drops upon sugar; but this is not to be taken before due evacuations have been first made.

After evacuations, great care must be taken that the cough be appeased, lest the lungs should be weakened by the continual agitation.

The most sovereign remedy to restore the lungs to their pristine vigour is to get on horseback every day; and he that will put himself upon this exercise for a cure, need not be tied down to any strict rules of diet, nor be debarred from any sort of meat or drink, since the whole stress of the matter depends wholly on the constant and continual exercise of riding. Long sea-voyages have of late been greatly recommended.

In the first stage of this disease, when the lungs, trachæa, and glands, throughout the whole pulmonary tube, are stuffed with a pituitous matter, separated from the mass of blood, and the patient is afflicted with a continual cough, especially in the night-time, all proper methods must be used to stop the influx of this catarrh, and to concoct the humours already impacted.

First, Blood must be taken from the arm, from six to ten ounces, if the patient is plethoric, or accustomed to bleeding; this is to be repeated once, twice, or thrice, at proper intervals, especially if the flux of serum is like a suffocating

stiffofating catarrh, together with the copious expectoration of a crude phlegm; or where there is an athmatic difficulty of breathing, a pain in the side, or the signs of any disposition to a rheumatism, a pleurisy, or a peripneumony.

After bleeding, especially if there is a nausea, or an inclination to vomit, it will be necessary to give an emetic with oxymel of squills [or ipecacuanha wine,] which will sometimes stop the progress of an incipient phtifis. The emetic, if it agrees with the patient, and there is occasion for it, may be repeated every third or fourth day. The best time is towards the evening; and after the operation is over, an opiate will be proper.

Nor must those remedies that soften; lubricate, thicken and concoct the phlegm, be omitted; such as sugar-candy, barley-sugar, old conserve of roses, juice of liquorice, the white and black troches of the London dispensatory; fresh butter in water-gruel, sweet oil or oil of sweet almonds, especially linseed oil cold drawn, of which the patient may take a spoonful every hour, unless there is a diarrhoea, or any other contra-indicating symptoms. He may also eat raisins and figs.

The air should be pure, far from bogs and marshy places, and the smook of sea-coal; the alimnt light of digestion; the drink small, for spiritous liquors should be avoided. The patient should use exercise, and keep his mind as free from passions as possible.

The second stage of this disease may be reckoned from the first formation of the tubercles, till they begin to inflame and putrify, that is, while they remain in a crude state. This is known from the increase of the hectic fever; from the wasting and flaccid state of the musculous flesh, from the dryness of the cough, for the spitting considerably abates; and from the great weight and oppression which is continually felt in the breast.

In this stage all evacuations by vomit, stool, and sweat, are pernicious; for they increase the fever, and accelerate the consumption. Nor is bleeding otherwise proper, than as it prevents an inflammation, and then it must be used with a sparing hand, when there are pleuritic pains, or the patient hath caught a fresh cold.

Besides alterative medicines, taken in small quantities, and at stated times, endeavours must be used to cool the febrile heat of the blood, and decrease the quantity of the noxious humours. The diet must be such as will obtund the acrimony of the humours; as partridges, mountain-birds, poached eggs, oysters, calves-feet and jellies, and soups made therefrom; also craw-fish and other shell-fish, and broths made of their flesh. Likewise spaw-waters, pectorals, hydromel, a milk diet, asses milk, milk-water, millepedes, snails, and the like; together with issues, shaving the head, and proper plaisters.

In the third stage of this disease little hopes remain of a cure, unless the ulcers are small and benign.

In this state of the disease, opiates should be sparingly used, even though the cough and want of rest require them, because they not seldom bring on sudden death. Jellies and broths are likewise to be directed; for, in short, there is now more help to be expected from the kitchen than from the apothecary's shop.

The diet should be water-gruel, ptisans of scalded apples, posset-drink, stonea raisins and liquorice, table-beer warmed with a toast, and the like. When the fever is on the decline, chicken broth, poached eggs, &c.

If there is occasion, the body must be loosened with clysters of sugared milk, with chamomile flowers, and repeated as occasion requires; then take away ten ounces of blood on the side affected, which should be boldly repeated every, or every other day, according to the urgency of the symptoms.

In colliquative sweats, pearl juleps may be freely given, to which may be added chalk, corals, dragon's blood, or other absorbents. But the Peruvian bark for this purpose, is much better than any other medicine whatever. The patient should not be permitted to sleep too long, the bed-cloaths should be light, and he should be removed to fine subtle air.

#### Of the NERVOUS CONSUMPTION.

A nervous atrophy or phtifis, is a wasting of the body, without any remarkable fever, cough, or difficulty of breathing; but is attended with want of appetite and a bad digestion; whence the whole body grows languid, and is continually falling away.

At first the body is oedematous, and as it were stuffed with a vapid chyle; the face looks pale and bloated, and the stomach loathes every thing but liquids. The patient is forced to keep his bed sooner than the progress of the decay of his flesh seems to require. The colour of the urine is uncertain, but it is generally very red and small in quantity; sometimes it is pale and copious.

No considerable fever is discernible either by the pulse, heat, or thirst, though the urine is ever so red.

The causes of this disease are generally violent passions of the mind, a too free use of spiritous liquors, and unwholsome air.

Stomachic and nervous remedies are only to be depended upon; such as, chalybeates, antiscorbutics, cephalics, and bitters. If the body be costive, two ounces of tinctura sacra may be taken every fourth evening, and from 30 to 40 drops of elixir aloes, in a glass of white-wine with bitters, before dinner. The elixir of vitriol is excellent in this case, 20, 30, or 40 drops is a dose, in any convenient vehicle, once, twice, or thrice a day. Also about half an ounce of the chalybeate wine, in some proper liquid, in the winter; in the summer, the spaw waters; the usual drink may likewise be made bitter with the *vinum amarum*; but nothing strengthens the stomach more than a decoction of wormwood.

Sometimes the patient may take eight or nine drops of opobalsamum, or spirit of hartshorn, or of sal ammoniac, as friendly to the nerves; nor must he forget exercise and chearful company, with other diversions.

#### Of an EMPYEMA.

An Empyema is a collection of purulent matter in the cavity of the thorax, between the lungs and the pleura, which always supposes the breaking of a vomica into the said cavity.

Such are the vomicae or abscesses of the lungs, proceeding from inflammations, from spitting of blood, from

a thick matter which cannot be expectorated. Of the pleura, from an inflammation, from a wound therein, healed outwardly but open inwardly; from a bruise, or a concealed rupture of it, turning to pus. Of the diaphragm, when, after an inflammation, it suppurates, and breaks on its upper part. Also of the mediastinum and pericardium affected in the like manner.

An empyema may be foreseen from an inflammation of any of the above mentioned parts, which is not terminated and resolved by concoction, revulsion, a crisis, or medicines; but is followed by shiverings, a febricula increasing at night, a wandering heat, a sense of heaviness in the part that was pained, a difficulty of breathing, a want of appetite, and an unusual thirst.

An actual empyema is known from twenty days being elapsed since the inflammation began, without expectoration of the matter; from the signs of a vomica in the five abovementioned parts disappearing; from a new pain, cough, difficulty of breathing, and spitting, arising, and afterwards going off; from a dry cough, a weight on the diaphragm, not being able to lie but on one side, a noise made by the fluctuation of the pus, upon moving the body; from a slow fever, a flushing in the cheeks, hollow eyes, heat in the ends of the fingers, crookedness of the nails, and a swelling of the abdomen.

The consequences of this disease are, a continual accumulation of pus from the ulcer not yet healed; the matter increasing in its acrimony, putrefaction, rank smell, and thinness, by being shut up in a hot, moist place; an impediment in raising the diaphragm and extending the lungs; a shortness and difficulty of breathing, and not easily performed unless in an erect posture, a dread of suffocation when laid down; an inability of lying, but on the affected side; a constant dry cough, with anxiety; a maceration and corrosion of the lungs, pleura, diaphragm, pericardium, and even of the heart itself, converting them gradually into filthy corruption; whence a hectic fever, quick, small pulse, constant redness of the cheeks, loss of appetite, perpetual thirst, extreme weakness, and fainting fits. Hence all the fluids become unfit for nutrition, circulation, or any other office: The consequence of which is, a wasting of the whole body; a putrefaction of the fluids, which may be discharged through the corroded lungs, or carried downwards by a fatal sanious diarrhoea; night-sweats, pustules in the face, crooked nails, a shining yellowness of the skin, and a hippocratic countenance.

The cure of this disease is different, according to its different cause and state.

When a vomica or abscess is known to be formed in any of the parts before mentioned, all endeavours are to be used, that it may be speedily broken and determined to the outward parts, which must be attempted by actual or potential cauteries, or by incision and proper motion.

When the vomica is actually broke, then it is to be evacuated by the mouth, if nature seems to encourage it; or by urine, if there appear any signs in it of passing that way; or by an aperture of the thorax by a proper instrument. See SURGERY.

In general, all inflammations of the lungs or pleura are

followed by an adhesion of these parts, which allow nature to make a passage externally: And it is common in abscesses of the pleura and intercostal muscles to find them break outwardly; nor is it uncommon even in the lungs. Therefore, when there is an adhesion, no other operation is necessary than to open the tumour with a lancet, when the pus is formed; and if the suppuration is so plentiful as not to admit the healing of the outward ulcer, it may be kept open with a hollow tent.

Hoffman gives an instance of a person, who, after a peripneumony, fell into an empyema, and was cured by taking milk boiled with sugar of roses. The quantity was three pints a-day. As also balsamic pills made of flowers of sulphur, oil of sweet almonds, sperma ceti, Venice turpentine, Saffron, and oil of aniseed. Likewise a powder made of crabs eyes, sperma ceti, sugar, myrrh, liquorice powder, and bole armoniac.

#### *Of the SCURVY.*

THIS distemper chiefly affects the inhabitants of cold northern countries, and especially those who live in marshy, low, fat and moist soils, near stagnating water, whether fresh or salt. Those who live idle sedentary lives are most subject, chiefly in the winter, to the attacks of this disease; as also those who feed upon salted and smok-dried flesh or fish, sea-biscuit, stinking water, fermented farinaceous vegetables, pease, beans, sharp salt old cheese; likewise those who are subject to melancholic, maniacal, hysterical, or hypochondriacal disorders.

It is known by spontaneous weariness, heaviness of the body, difficulty of breathing, especially after bodily motion; rottenness of the gums, a stinking breath, frequent bleeding of the nose, difficulty of walking; sometimes a swelling, sometimes a falling away of the legs, in which there are always livid, plumbeous, yellow, or violet-coloured spots; the colour of the face is generally of a pale tawney.

The first state of this disease begins with unusual laziness, spontaneous weariness; the patient loves to be in a sitting or lying posture; there is a pain in all the muscles, as if he was over tired, especially of the legs and loins; when he wakes in the morning, all his joints and muscles seem to be tired and bruised.

In the second state, the gums swell, grow painful, hot and itching, and bleed upon the least pressure; the roots of the teeth become bare and loose; he feels pains in all the external and internal parts of the body, imitating distempers proper to the various parts.

In the third state, the gums at length grow putrid, with a cadaverous smell; when they are inflamed, blood distils from them, and a gangrene ensues; the loose teeth by degrees grow yellow, black, and rotten; the sublingual veins become varicous, and like rings; there are often fatal hæmorrhages, which break out from the external skin, without any appearance of a wound from the lips, gums, mouth, nose, lungs, stomach, liver, spleen, pancreas, intestines, womb, kidneys, &c. Obstinate ulcers arise, of the very worst kind, which no applications will cure, and which are apt to turn to a gangrene; they break out in all parts, but especially the legs, and are attended with a stench. There is a kind of an itch and dry scabs, with

with a dry and mild leprosy. The blood drawn from a vein is black, grumous, thick, and yet wants its due consistence in the fibrous part; the serum is salt, sharp, and abounding with a yellowish green mucus on its surface. There are gnawing, rending pains, quickly shifting from place to place, which grow more violent in the night, affecting all the joints, bones, and viscera.

In the fourth state, there are fevers of various kinds, which bring on an atrophy; sometimes diarrhoeas, dysenteries, or violent stranguries; as also faintings and mortal anxieties, a dropy, consumption, convulsions, trembling, a palsy, contractions, black spots, voiding of blood upwards and downwards, a putrefaction and consumption of the liver, spleen, pancreas, mesentery. Now the contagion spreads very quick.

The first sign of the approach of this disease is commonly a change of colour in the face, which becomes pale or yellowish, and bloated, with a listlessness, and an aversion to exercise. The caruncles of the eyes appear of a greenish cast, and yet in other respects the patient seems in perfect health. However, the change of colour in the face does not always precede the other symptoms, though it constantly attends them. Then an universal lassitude supervenes, and a stiffness and feebleness of the knees, with a difficulty of breathing on the least motion. Soon after this there is an itching of the gums, which swell, and are apt to bleed on the least friction. Then they become livid, soft and spongy, and afterwards extremely putrid and fungous. This rottenness of the gums is an inseparable sign of this disease. These are not only subject to bleed, but there are hæmorrhages from different parts of the body.

The skin is dry throughout the whole course of this disease, except towards the last, and in many it is rough. In some it appears like the skin of a goose; but it is most frequently smooth and shining. It is stained with blue, purple, livid, or black spots; some of which are small, and others of a hand's breadth, when the disease is advanced. They are chiefly on the legs and thighs, but sometimes on the arms and trunk of the body. Some have a swelling of the ankles in the evening, which disappears in the morning. In a little time it advances gradually up the leg, and the whole member becomes oedematous. Hurts, bruises, wounds healed up, and fractured parts, always become scorbatic first. Old ulcers will emit a thin fetid sanies, mixed with blood, and at length coagulated gore will lie on the surface of the sore like a cake. As the disease increases, they shoot out a soft, bloody fungus resembling bullock's liver, which sometimes will rise to a monstrous size in a night's time. The slightest bruises and wounds of scorbutic persons degenerate into such ulcers, and are easily distinguished from all others, by being putrid, bloody, and fungous.

To prevent the scurvy at land, it will be proper to chuse a warm, dry, pure air, with a diet of easy digestion, consisting chiefly of a due mixture of animal and vegetable substances; for those are most liable to it who live in marshy, wet soils, and in places subject to great rains and fogs; or in damp, low apartments, unless they keep constant fires, and their chief food be flesh broths, with plenty of fresh greens or vegetables, and well-baked

bread made of wheat-flour; as also a chearful glass of some good wholesome fermented liquor. Cleanliness, entertaining amusements, and moderate exercise, will also be good preservatives in these cases. In garrisons, the soldiers should be kept as dry, clean, and warm as possible, and their provisions should be as wholesome as can be procured, with plenty of good vegetables, particularly sallads of garden-creffes.

The best method of preventing the scurvy at sea will appear from the effects which Dr Lind has observed several medicines have had, especially those which have been greatly recommended as preservatives. On the 20th of *May* 1747, being on board the *Salisbury* at sea, he took twelve scorbutic patients under his care. They had putrid gums, spots, and lassitude, with weakness of their knees. They had a proper apartment in the forehold: their diet was water-gruel sweetened, in a morning; sometimes mutton broth for dinner, sometimes light puddings, boiled biscuit with sugar, &c. and for supper, barley and raisins, rice and currants, sago and wine, and the like. Two of these were ordered each a quart of cyder in a day; two others twenty-five drops of elixir of vitriol, three times a-day, upon an empty stomach, using a gargle acidulated with the same. Two others took two spoonfuls of vinegar three times a-day; having their gruels, other food, and gargles, well acidulated with it. Two of the worst patients, with the tendons of the ham rigid, were put under a course of sea-water, and drank about a pint every day, more or less, according to its operation, which was intended to be as gentle physic. Two others had each two oranges and one lemon given them every day, which they eat with greediness upon an empty stomach, at different times. This course was continued but six days, because no more fruit could be allowed. The two remaining patients took the bigness of a nutmeg, three times a day, of an electuary made of garlic, mustard seed, balsam of Peru, and gum myrrh; using for common drink barley water well acidulated with tamarinds; by a decoction of which, and cream, they were gently purged three or four times during the course.

The oranges and lemons had the best effect; for one of those who had taken them, was at the end of six days fit for duty; and he took nothing more but a gargle of the elixir of vitriol for his gums, which were not quite sound, and so recovered his health entirely. The other being more recovered than any of the other patients, was appointed to look after them. Next to the oranges the cyder had the best effects, though it was not very good, being prick'd; for those who drank it were in a fairer way of recovery at the end of the fortnight, the time allowed for making the experiments, than any of the rest. Elixir of vitriol did no good unless as a gargle, nor yet any of the rest of the medicines. Oranges are preferable to lemons; for by these the lord Anson's people were so speedily and surprisingly recovered at the island of Tinian. Besides, Mr Murray affirms, from experience, that oranges and lemons, when properly and sufficiently used, are an infallible cure in every stage and species of this disease, if there is any degree of natural strength left, and where a diarrhoea, hientery, or dysentery, are not joined to the

the other symptoms. He observes farther, that at the island of St Thomas, fifty men belonging to the Canterbury, and seven to the Norwich, who were in all the different stages of this distemper, were cured in little more than twelve days.

But as oranges and lemons are apt to spoil, let the juice of these fruits be well cleared from the pulp, and deperated by standing some time; after which it may be poured off from the gross sediment. Let it then be poured into any clean open vessel of china or stone ware, which should be wider at the top than at the bottom, that it may evaporate more readily. But a china basin or punch-bowl is most proper, on account of the form. Put this into a pan of water over a clear fire; let the water come almost to boil, and continue nearly in that state, with the bowl full of juice in the middle of it, till the juice is found of the consistence of a thick syrup when cold. The slower the evaporation of the juice is, the better; that is, it ought to continue twelve or fourteen hours over the fire: When it is cold, it is to be corked up in a bottle for use. Two dozen of good oranges weighing five pounds four ounces, will yield one pound nine ounces and a half of deperated juice; and when evaporated, there will remain five ounces of extract, which in bulk will be equal to less than three ounces of water. So that twelve dozen of oranges may be put in a quart bottle, and preserved several years. The same may be said of lemons. When this is mixed with water and made into punch, few are able to distinguish it from the fresh juice mixed up in the same manner. However, when the fresh fruit can be had, the fragraney of the peel may contribute somewhat to the cure of the scurvy; and when these are wanting, the same thing may be obtained from a few drops of their essence, or the aromatic oil contained in their rinds; and if a small quantity of this be added to the extract, it will give it the smell and fragraney of the fresh fruit in great perfection. Or rather add a little of the outer peel to the extract a little before it is taken off the fire, and then the nicest taste will not be able to distinguish the difference between the fresh fruit and this. The virtues of this extract, thus made, lie in so small a compass, that a bottle will serve one man at sea several years; for in the making of it there is little or nothing flies off besides the water.

It will likewise be of great use to seamen to have gooseberries, and the like, preserved in bottles in the same manner as the pastry-cooks; as also small onions pickled in vinegar, cabbage, french beans, &c. may be preserved, by putting them in clean dry stone-jars, with a layer of salt at the bottom, then a thin layer of the vegetable covered with salt, and so alternately till the jar is full. Then the whole must be pressed down with a weight, and its mouth quite stopped that no air or moisture may enter. Thus the vegetable may be kept fresh and green for a whole year. At the time of using, the salt is to be washed off with warm water. This is the manner by which they preserve that never-failing remedy, Greenland scurvy-grass. Every common sailor ought to lay in a stock of onions, for they are a great preservative at sea. The Dutch sailors are preserved from the scurvy by pickled cabbage. Portable soup may be carried to all

places. When the scurvy begins to make its appearance, sailors should be abridged in the same degree of their allowance of beef and pork, and eat them with mustard and vinegar; but the pease ought always to be served out in full allowance. It must be observed likewise, that a soup of boiled cabbage and onions will cure an adventitious scurvy in its first stage, either at land or sea, in any part of the world.

Besides fresh and preserved fruits and vegetables, fermented liquors of all sorts are good, but more particularly cyder. Among these are included many wines of every kind; or the juices of fruits may be fermented with ale. Poor people that winter in Greenland under vast disadvantages in point of air and diet, preserve themselves from the scurvy by spruce-beer, which is their common drink. Likewise the simple decoction of fir-tops has done wonders. The shrub black spruce of America makes this most wholesome drink just mentioned, and affords a balsam superior to most turpentines. It is of the fir kind. A simple decoction of the tops, cones, leaves, or even of the green bark or wood of these, is an excellent antiscorbutic; but perhaps it is much more so when fermented, as in making spruce-beer. This is done by molasses, which by its diaphoretic quality makes it a more suitable medicine. By carrying a few bags of spruce to sea, this wholesome drink may be made at any time. But when spruce cannot be had, the common fir-tops used for fuel in the ship should be first boiled in water, and then the decoction should be fermented with molasses; to which may be added a small quantity of wormwood and root of horse-radish. The fresher it is drank, the better. When other things are wanting, tar-water may be fermented in the same manner.

Those who have been weakened by long fits of illness should have the scurvy prevented by panada of bread newly baked, with a few drops of the extract of lemons, and a spoonful of wine; as also oatmeal and rice, gruels, stumery, stewed barley, with raisins or currants, sago, and wine, &c. But more particularly pickled cabbage, and small onions boiled with the portable soup made weak. Most of their food ought to be acidulated with orange or lemon juice; and then as their strength increases, they should be indulged with more solid food. But before this, they should have a small quantity at a time and often, and they should be brought back to their labour by little and little. Exercise on a deal-board, with the ends laid on two chests, will be very proper; because it promotes the circulation, and strengthens the fibres, without any loss of spirits.

Bad air of any kind has a bad effect upon a ship's crew; to remedy which, a red-hot loggerhead should be put into a bucket of tar, and moved about, so that all the ship once or twice a-day should be filled with this wholesome antiseptic vapour. In a moist air, whatever promotes perspiration is proper; such as dry linen, cleanliness, using the flesh-brush, garlic or raw onions before going into the rain, and keeping the bedding dry. Plenty of mustard and onions should be used with their virtuales.

The cure of this disease has been in a great measure anticipated by the means of prevention, inasmuch that little remains to be said about it. The diet should be

light

light and easy of digestion, such as broths or soups made of fresh meat, with plenty of vegetables, such as cabbage, coleworts, leeks, onions, &c. The bread should be fresh and well baked; and fallads of all kinds are beneficial, but more particularly dandelion, sorrel, endive, lettuce, fumitory, and purslane; to which may be added, scurvy-grafs, cresses, or the like, to correct the cooling qualities of the former. Summer fruits are all good, as oranges, lemons, citrons, apples, &c. The drink may be good found beer, cyder, or Rhenish wine. Physic is never necessary if the fresh broths and greens keep the belly open, and pass freely by urine, sweat, and perspiration. If otherwise, the patient may take a decoction of tamarinds and prunes with a diuretic salt; and on intermediate days he may be sweated with camphorate boluses of theriac and warm draughts of a decoction of the woods, of twelve or fifteen grains of the Squill pills of the Edinburgh dispensatory.

Milk of all sorts, if it agrees with the constitution, will be very beneficial, as well as whey, which is preferable. Sal polychrest is use as a mild purgative and excellent diuretic. The scorbutic juices, qualified with the juice of Seville oranges, are proper, especially mixed with the clarified whey, with sweating twice or thrice a-week with the said juice mixed with sack-whey; for this is an evacuation which scorbutic persons bear the best. When there is no danger of an hæmorrhage, warm baths, with rosemary, marjoram, thyme, &c. may be good. In the winter-time, genuine spruce-beer, with lemons and orange juice, is proper; or antiscorbutic ale, made of an infusion of wormwood, horse-radish, mustard-seed, and the like; and it may be made laxative with the addition of fenna. It must be drank while pretty fresh or new. Van Swieten says, he has often seen whole families cured of the scurvy, in Holland, by the use of a cask of ale, in which were put heads of a red cabbage cut small, twelve handfuls of cresses or scurvy-grafs, and a pound of fresh horse-radish previously infused.

When the gums begin to itch and are spongy, use a gargle of the bark infused in brandy. When the putrefaction increases, use barley-water and honey of roses, acidulated with a mineral acid. The fungus must be kept down and, when necessary, cut away. The ulcers of the gums must be checked with a touch of spirit of salt, or oil of vitriol diluted. When the legs are swelled, or œdematous, gentle frictions are to be used at first with warm flannel, or with woollen cloths charged with the fumes of benjamin and amber, provided the swelling be small, soft, and not very painful, rolling them up afterwards with an easy bandage from below upwards: But if they are much swelled, stiff, and painful, they must be fomented with a discutient fomentation, or rather the steam of the fomentation should be received through a blanket rolled round the limb. This operation, repeated night and morning, will render the contracted joints supple. After this has been continued for half an hour, the parts are to be anointed with palm oil. If a vegetable diet does not reduce the limb, sweat it with burning spirits, or bags of warm salt.

Ulcers of the legs must be treated with very gentle compression, to keep the fungus under; and the same ap-

plications must be used as to the rotten gums. Mr. Murray has found a strong tincture of the bark of great service in scorbutic ulcers. In dangerous hæmorrhages the mineral acids must be given by a little at a time and often; such as the spirit or elixir of vitriol, together with small doses of the Peruvian bark.

A scorbutic diarrhœa should not be suddenly stopt at sea, but the peccant humour must be gently evacuated with small doses of rhubarb, and the perspiration kept up with a little theriac or diacordium, with other warm diaphoretic and strengthening medicines. In extreme cases, opium may be given more freely. The diet must be glutinous and subastrigent, with strong rough red wine diluted. Sometimes five grains of alum may be given with the diacordium, especially when blood is evacuated in great quantities. The most effectual remedy in scorbutic dysenteries is an infusion of ipecacuanha in brandy, given in small doses, and often repeated.

Physicians refer the different symptoms of this disease to different salts; but their different and far-fetched corrections of these salts are plainly ridiculous. Water is the known solvent of all salts, and this intention will be best answered by pure and light simple water. The universal remedy for a scurvy consists in mineral waters.

After mineral waters, nothing is more effectual in correcting a scorbutic acrimony than a milk diet, or whey alone, or impregnated with the juices of antiscorbutic herbs, such as scurvy-grafs and water cresses.

As to evacuations, bleeding should be used with the greatest caution; and none but the gentlest purges should be given, such as fenna, rhubarb, or manna. The diuretics should not be stronger than the decoction of the roots of parsley, celery, fenel, and asparagus. The safest diaphoretics are, dulcified spirit of nitre, flowers of sulphur, ethiops mineral; infusions, in the manner of tea, of Paul's betony, carduus benedictus, scordium, and elder-flowers.

In the hot or alkaline scurvy, scurvy-grafs is too warm to be administered alone, and should be corrected with acids, such as wood-sorrel, the juices of citrons, oranges, barberries and pomegranates. Or mix the conserve of scurvy-grafs with an equal quantity of the conserve of wood-sorrel, and give it twice or thrice a-day, with some antiscorbutic water. This should be accompanied with milk-meats, almond-emulsions, barley-broths, water-gruel, chicken-broths, with endive, lettuce, sorrel, and cresses, interposing, at proper intervals, gentle laxatives and diuretics.

When the scurvy proceeds from muriatic salts, which happens to those who live on smoked or high-salted fish or flesh, and have corroding ulcers, a stinking breath, putrid gums, a thick and saltish urine, as is generally observed in old sailors; then whey, long and copiously drank, produces happy effects; as also citrons, China oranges, and ripe fruits; whereas spirituous and volatile antiscorbutics are generally detrimental. Hoff.

But if crusty black ulcers require external remedies, we should only use preparations of the yolk of an egg, myrrh, olibanum, saffron, oil of roses, and Peruvian balsam. When there is an excessive impurity of the humours tending to putrefaction, scarifications will induce

a gangrene, which may be prevented by lime water, exalted with camphorated spirit of wine and sal ammoniac.

But fomentations and cataplasms of the common hemlock, frequently repeated and duly continued, are found more effectual than all other remedies.

#### Of the DROPSY.

DROPSIES are of various kinds; but those usually treated of by authors are the anasarca, ascites, and tympanites.

When the lymph stagnates throughout the whole habit of the subcutaneous fat, or is shed therein, it produces an anasarca, which extends itself also to the abdomen and scrotum.

When the water is collected in the duplicature of the peritonæum, in the cavity of the abdomen, between the peritonæum and the viscera of the abdomen, or in the dilated cavities of the glands and vessels contained in the abdomen, it is called an ascites. If the dropsy is owing to the rarefaction of some steam or vapour, arising from water, pus, ichor, or air, pent up and heated till they putrefy, then it is a tympany.

The cause of these diseases may be, a family disposition thereto; a hasty drinking too great a quantity of cold water, and its not being evacuated upwards or downwards, or by sweat, or urine excited by heat or motion; acute diseases, especially the most ardent, attended with unquenchable thirst, or otherwise; a lenterious dysentery of a long continuance; all obstinate obstructions of the viscera; and a schirrus of the liver, spleen, pancreas, mesentery, kidneys, womb, or intestines; the jaundice; a violent quartan ague of long duration; a lenterious dysentery; a diarrhœa; a long dysentery; the cœliac passion, an empyema; a consumption; the gout; too great evacuations, chiefly the blood; the drinking of sharp, fermented, and spirituous liquors; the feeding on tenacious and hard aliment; very large and numerous hydatides hanging in the cavity of the abdomen; melancholy; the scurvy, and the like.

The first sign of the approach of this disease is the swelling of the feet and ankles, which in the evening will pit, if pressed with the fingers; which swelling disappears in the morning, especially if there begins to be a difficulty of breathing. And yet it must be remembered, that pregnant women, or whose menses are stopped, as also when suddenly freed from an inveterate asthma, are affected with the like swelling. When the feet and legs are distended to the utmost, the waters rush into the abdomen, and cause it to swell by little and little, till at length the more noble viscera are affected therewith, and the patient is soon overwhelmed with the deluge. In proportion as the diseased parts increase in bulk, the rest fall away: at the same time the difficulty of breathing, paucity of urine, and intense thirst, the three principal symptoms, grow more intolerable.

When the abdomen is swelled, it will sound, when struck, if the disease is a tympany. In the ascites there is a noise of the fluctuating water upon bodily motion, unless the waters are inclosed in a cystis or bag.

Besides the above-mentioned symptoms, there is a

heaviness, a torpor, a costive body, and at length a slow fever; the patient never sweats. In process of time, the stagnating waters, being pent up in a hot place, become acrimonious; hence ulcers, gangrenes, bleeding at the nose, a protuberance of the navel, a mortification of the viscera, and death.

The curative indications in an anasarca, as well as in an ascites, are to restore the humours to their natural fluidity; to invigorate the languid circulation; to brace up and strengthen the relaxed solids; to promote the secretions; and to carry off the redundant stagnating juices.

Strong drastic purges, steel medicines, absorbents, detergents and stomachics, are best suited to answer these intentions.

The first thing to be done is to evacuate the serous humours by cathartics.

There are two things of uncommon efficacy in the dropsy; these are, elaterium and antimonial wine, especially for those which are not easily purged; two grains of the former is a proper dose for most constitutions.

As for the antimonial wine, an ounce and a half, or two ounces, as the patient's strength will admit, given in the morning, will in due time free the abdomen from the load of water. If it does not purge downwards as well as upwards, mix it with syrup of buckthorn after the third or fourth dose.

Some greatly recommend Bontius's pills for the dropsy, the dose of which is from half a scruple to a scruple; but Heister prescribes them from half a dram to a dram.

Mayrne affirms, that mercurius dulcis, without doing any mischief to the body, acts directly upon the morbid cause, and if possible destroys it. If a salivation follows, it is not dangerous, but may be prevented if the mercurial be joined to an active cathartic.

Many praise the juice of the root of iris palustris lutea; and we have an instance of its efficacy in a most deplorable dropsy, in the *Med. essays*; eighty drops of which were given every hour in a little syrup of buckthorn, which brought away many quarts of water by stool the first night; the quantity was daily increased till it came to two drams, and at last was mixt with a fourth part of the syrup, and given by spoonfuls.

Sometimes purgatives are to be entirely omitted, when the patient is of a weak constitution, or women subject to vapours; and then diuretics only should be made use of; among which, those are most powerful which consist of lixivial salts.

Boerhaave likewise proposes to attenuate the humours by small doses of mercurial preparations, to be taken every other morning, in a little pulp of a roasted apple; as half a grain of turbith mineral, with ten grains of white ginger; or one grain of red precipitate, with six grains of nutmeg; or seven grains of calomel, with eight of winter's bark.

Some have been cured by a pertinacious abstinence from all liquids, living upon sea biscuit with a little salt, and a very little rich wine. Externally, frictions of the parts have been found beneficial.

*Of the HYDROCELE, or DROPSY of the SCROTUM.*

THE hydrocele, called the dropsy of the scrotum, *hernia aquosa*, and the dropsy of the testicle, is an aqueous tumour of the scrotum. Though authors mention several kinds, there are but two. The first is, when the water is contained in the tunica vaginalis; the second, when it is contained in the cellular membrane of the scrotum. This last is almost always complicated with an anasarca, a kind of dropsy which consists in the extravasation of the water which lodges in the cells of the *membrana adiposa*. The hydrocele in this case is known without any difficulty; for the skin is shining and soft, yielding easily to a slight impression, which will remain pitted for some time; the penis is also sometimes prodigiously swelled by the liquor which insinuates into the cellular membrane. There are none of these symptoms in the dropsy of the tunica vaginalis.

In the dropsy of the cellular membrane of the scrotum, some recommend the puncture with a trochart; others, to make small apertures here and there with the point of a lancet; others, to put a small skean of silk through the skin with a needle, and to let it remain as a seton, till all the water is drained off. But the two first methods yield very little relief, and the last may be more likely to induce a gangrene. Nor is there occasion for any operation at all, because the cellular membrane of the scrotum is nothing but a continuation of the *membrana adiposa*; and therefore scarifications made in the skin of the small of the legs will effectually empty the scrotum.

Yet sometimes there falls so great a quantity of water into the scrotum that the distension is very painful, threatening a mortification. Likewise the prepuce very often is so excessively dilated and twisted, that it hinders the patient from making water.

In these cases there should be an incision made on each side the scrotum, three inches in length, quite through the skin, into the cells which contain the water; and likewise two or three, half an inch long, in any part of the penis, with a lancet or knife.

The dropsy of the tunica vaginalis is caused by an excessive accumulation of a serosity, which is naturally separated in the internal surface of that tunic in a small quantity, to moisten and lubricate the testicle. Authors have hitherto distinguished them into two sorts: the one on the inside of the tunica vaginalis; and the other on the outside, between that and the scrotum, which they suppose to proceed from water in the dropsy ascites. But anatomy shews the absurdity of this opinion: for besides that persons afflicted with this kind of hydrocele have seldom any other dropsy, and those who have the ascites are free from this hydrocele, the tunica vaginalis is like a purse quite shut up on the outside of the abdomen, so that the water cannot insinuate into it from any part.

As to the notion that the water falls from the abdomen into the interspace between the tunica vaginalis and the scrotum, it is equally impossible. For though in the intestinal rupture the gut falls into this place, yet it brings the peritonæum along with it, and that will prevent the egress of the water. This is a circumstance the ancients were unacquainted with, and the moderns have not sufficiently attended to.

This disorder is seldom attended with pain in the beginning, contrary to what happens in the hernia of the epiploon, and of the intestine; nor is it often the effect of any accident. It never diminishes when once begun, but generally continues to increase; but in some persons not so quick as in others. In one person it will grow to a very painful distension in a few months; in another it shall not be troublesome in many years; nay, it shall cease to swell at a certain period, and afterwards continue in that state without any notable disadvantage. But this is rare.

In proportion as it enlarges, it becomes more tense, and then is said to be transparent; but this is not always the case; for sometimes the scrotum is very much thickened, and the water itself opaque; so that to judge positively if there be a fluid, we must be guided by feeling a fluctuation; and though sometimes it is not very evident, yet we may be sure there is a fluid of some kind, if we are certain that the distension of the tunica vaginalis makes the tumour.

When a gut, or the omentum, form the swelling, it is soft and pliable, unless inflamed, and uneven in the surface, and reaches from the scrotum into the very abdomen; whereas the hydrocele is tense and smooth, and ceases before, or when it arrives at the rings of the abdominal muscles.

When the testicle is increased in size, the tumour is rounder, and, if not attended with an enlargement of the spermatic vessels, the cord may be easily distinguished between the tumour and the abdomen; but without this the pain or the very great hardness will discover it to be a disease of the testicle.

As to the cure, little is to be expected either from inward medicines or outward applications. Therefore it will be most advisable to wait till the tumour becomes troublesome, and then to tap it with a lancet.

*Of the JAUNDICE.*

THE jaundice is a disease which is principally discovered by the yellow tincture of the skin, but most distinctly in the coats of the eyes, where it gives the first notice of its invasion.

The symptoms are, heaviness, inactivity, lassitude of the whole body, anxiety, uneasiness about the hypochondria, sickness at the stomach, oppression in the breast, difficult respiration, a dry and harsh skin, costiveness, hard white excrements, yellow high-coloured urine, which will tincture linnen or paper with a saffron hue; there is a bitter taste in the mouth; and all objects seem to be discoloured.

The immediate cause of a jaundice is an obstructed excretion of the bile from the vesica felis and liver into the duodenum; which being forced back upon the liver, mixes with the blood, by which it is carried into the whole body, whence the skin and urine will be tintured with the colour of the bile.

This obstruction may be occasioned by any thing in the duct, which plugs up the passage, or by external pressure closes its mouth, or by a spasm contracting the fibres thereof. Hence we may conceive why the jaundice succeeds the flatulent colic, why pregnant women

are subject to this disease, and why spasms of hypochondriacal and hysterical persons produce the same effect. Sudden frights, the generation of too great plenty of bile, scirrhus tumours or ulcers of the liver, obstructions of the menes, obliquate intermitting fevers, and the bites of venomous animals, will also produce this disease.

The prognostics of this disease differ with regard to the patient's age, habit, strength, and constitution, as well as with respect to the virulence or mildness of the causes, and its duration. When the patient is young, and the disease not complicated with any other, such as a quartan ague, the affectio hypochondriaca, or an obstruction or scirrhus of the liver, and has not continued long, it is easily cured. But if after the cure it frequently returns, with a yellow greenish colour, and an induration of the liver, it generally terminates in a hectic or an hæmorrhage. A jaundice arising from violent transports of anger, or the spasmodic stricture of the intestines or biliary ducts, caused by a drastic purge or emetic, is easily cured if taken in time; but if encouraged by grief, or the body is weakened by a previous disorder, the cure is more difficult.

Emetics are highly proper in the cure of the jaundice, and yield speedy relief, if the disease does not proceed from violent anger, spasms of the stomach, a cardialgia, a spasmodic colic, or a stone lodged in the cystic duct, exciting a violent uneasiness about the præcordia. But when a bilious fordes, lodged in the duodenum, and closing up the orifice of the ductus choledochus, intercepts the passage of the bile; or when a tenacious, moveable, and not highly concremented bilious matter, plugs up the hepatic ducts, emetics are of singular efficacy in evacuating it. A scruple of ipecacuanha, with a grain of tartar emetic, will be a proper dose; or two grains of tartar emetic, in a draught of generous wine, or in an infusion of manna, drinking water-gruel after it.

Likewise in this case, after emetics, cathartics will be proper, compounded of aloetics and mercurials: Then saponaceous attenuants, preparations of tartar, and volatiles.

And here we must recommend the terra foliata tartari, otherwise called tartarum regeneratum, [and by the college, Sal diureticus.] as the greatest dissolvent, and the most powerful remedy in this disease. It dissolves the most tenacious substances, and opens all obstructions of the viscera; and yet has no acrimony, and may be safely given in the pleurisy and dropsy. Its dose is from five grains to a scruple and upwards.

When a jaundice is attended with an hæmorrhage, it is always dangerous, because it denotes a most acrimonious and dissolved state of the blood: in which case, attenuants, aloetics, volatiles, and chalybeates, are little better than poison; whereas acids, diluents, demulcents, and mineral waters, are very beneficial. Hemp-seed, boiled in milk till it breaks, is often advantageous, [the dose is 5 ounces twice a-day,] or an emulsion of white poppy seeds and sweet almonds, after moderate bleeding, (if the patient is feverish, and the pulse will allow it) and gentle purging.

#### *Of the BILIOUS COLIC.*

A BILIOUS colic is attended with the following symptoms; a hoarse voice, a cardialgia, a continual loathing of victuals, a vomiting of bilious poraceous matter, hiccup, a feverish heat, inquietude, intense thirst, a bitter taste in the mouth, and the urine little and high coloured. HOFF. Add to these, a burning, acute, continual pain about the region of the navel, which either seems to bind the belly as it were with a girdle, or is contracted into a point as if the patient was bored through, which sometimes remits, and then grows more violent. In the beginning it is not so much determined to one point, nor is the vomiting so frequent, nor does the body so obstinately withstand the force of cathartics. But as the pain increases, the more it is fixed to a point, the vomiting is more frequent, the body more coltive, till at length it terminates in the iliac passion. At this time the pain is so intense as to occasion a singultus, a delirium, coldness in the extremities, and chilling, clammy sweats, which are always a dangerous omen in this disease.

It is distinguished from a sit of the gravel, as the pain in this lies in the kidney, and is extended from thence by the ureter to the testicle; after eating, the colic pain increases, the nephritic abates; evacuations upward or downwards relieve the colic more than a sit of the gravel. The urine in the latter is more clear and thin at first, afterwards there is a sediment, and at length gravel or small stones; whereas in the colic the urine is more thick in the beginning.

Bleed freely in the arm; and after three or four hours exhibit an anodyne, and the next day a gentle cathartic, which may be repeated every other day, to the third time.

Sydenham recommends riding, especially when the cure is only palliated with opiates.

If the disease is caused by a plentiful eating of summer-fruits, the patient should drink posset-drink plentifully, then take an anodyne, and bleed the next day.

Ruffel observes, that when the colic proceeds from coarseness without a fever, then a pint of sea-water, drank every morning, will cure it. But if the first onset of the disease is neglected, and it proceeds to an inflammation, with a fever, vomiting, and retention of the excrement, and there is reason to be apprehensive of the iliac passion; when black vomiting supervenes, and the fæces are thrown up by the mouth; as also when there is a quick weak pulse, and cold sweats supervene; then the patient will be carried off by a mortification. Sometimes after the rigors, pus will show itself in some place or other, which prevents immediate death; while a purulent tenefmus afflicts the unhappy patient.

#### *Of the HYSTERIC COLIC.*

THIS is a common symptom of the hysteric passion, and is attended with a most violent pain about the pit of the stomach, as also with a vomiting of a greenish humour, and a great sinking of the spirits: After a day or two the pain goes off, but upon the slightest motion or perturbation of the mind it soon returns again.

Neither

Neither bleeding nor cathartics have any place in the cure, for they exasperate the distemper; nay, the most gentle clysters are prejudicial: For this disease seems rather to proceed from a disorder of the spirits, than from a fault of the humours. It will be proper first to advise the patient to drink upwards of a gallon of posset drink; to clear the stomach of its impurities, by throwing it up again, that the effects of the purgative may not be hindered. Afterwards give 25 drops of the thebaic tincture, in an ounce of cinnamon-water. This last is to be repeated at due intervals, till the symptoms disappear; that is, the effect of one dose must be known, before another is given. Yet sometimes, in plethoric bodies, if the strength will permit, it is better to prepare the way, by bleeding and purging, or both, for an anodyne.

*Of the FLATULENT or WIND COLIC.*

If there is a fixed and tensive pain in the right or left hypochondrium, or beneath the stomach, it is a certain sign that there is wind or excrements pent up in the flexures of the colon. If the pain is in the small guts, the abdomen will be wonderfully swelled and puffed up; and the force of the wind is often so great, and it distends the skin to such a degree, that the pain is exasperated merely by touching it; nor do there want instances of a navell-rupture arising therefrom. The pains are very acute, the body extremely costive, there is a sense of a very great tightness or contraction; and if the stomach is inflated, the breathing becomes very difficult, and the eruptions are attended with some small relief. Afterwards there are cardialgic passions, and an ineffectual reaching to vomit.

If the disorder lies in the flexures of the colon, emollient and discutient clysters will be proper, as also carminative and emollient liniments applied to the pained part.

When the body is opened, it will be beneficial to give some lenient purge, as manna, cream of tartar, terra foliata tartari, with a spoonful or two of oil of sweet almonds.

While the pain is violent, the infusion of chamomile flowers and yarrow, in the manner of tea, frequently drank, is a very powerful remedy.

It will be also beneficial to apply hot bricks or tiles to the part affected; also bags with parched oats and carminative ingredients, as carraway seed, juniper and bay berries, with decrepitated salt. A clyster of the smoak of tobacco, blown through a pipe into the anus, is reckoned an excellent thing.

When indurated fæces plug up the intestinum rectum, so that the wind and scybals can make no exit, then the anus is to be fomented with emollient decoctions; and saline suppositories, with fat, are to be used; also some ounces of linseed oil, with an emollient decoction in which Venice soap has been dissolved, are to be injected as a clyster.

*Of the COLIC from Fumes of Lead.*

THIS is a disease to which all workers in lead are subject; and is attended with an intolerable pain in the intestines, and a most costive body: the navel is drawn in-

ward, there is the highest inquietude and a contraction of the joints, attended with a nausea, and a constant reaching to vomit. It is apt to terminate in a kind of palsy, or a spasmodic asthma, and afflicts the patient a long time. It is sometimes owing to the rashness of medecasters, in giving preparations of lead in the gonorrhœa and other distempers.

There is no better preservative against this disease, than by taking fat broth in a morning; the cure is to be attempted with oleous clysters, and a plentiful use of oil of sweet almonds taken by the mouth, with or without a solution of manna, by which the desired end will generally be obtained. For the cure for the pæresis, baths of sweet water are necessary; after which the spine of the back must be anointed with a liniment made of the fat of a hog, expressed oil of nutmegs, saffron, and oil of rosemary, which is a speedy and a certain remedy.

This disease is called mill reek by the miners at lead-hills in Scotland, which all the inhabitants there are subject to; but melters of lead have it with the greatest violence.

In the slighter stage of it, there is an uneasiness and weight about the stomach, particularly near the cartilago ensiformis, and sometimes it is like a colic in the intestines. The spittle of the patient is sweet, and inclining to a bluish colour, resembling that of a person who chews lead. The pulse is lowish, and the skin is all over cold, with frequent clammy sweats. The legs become feeble, with a pricking numbness; and the whole body is lazy and feeble. Sometimes a spontaneous diarrhœa carries off the disease; but if it continues long, it is very prejudicial. During this stage the patient is able to work.

When these symptoms continue long, and spirituous liquors are drunk on an empty stomach, or after the working of lead, the second stage comes on; and then there is a fixed pain in the stomach and guts, especially in the lower part of the belly, extending from one hip-bone to the other, with costiveness and a gnawing pain. The pulse then becomes weak, and the skin hot. There is likewise a giddiness and a violent pain in the head, which is succeeded by an insensibility and a delirium of the worst kind; for they bite their hands and tear their own flesh. Then their extremities tremble with convulsions; and at length they sink with an intermitting pulse, and die of a coma or apoplexy.

If proper medicines are given in the first stage of the disease, the patient generally recovers. If it proceeds till the giddiness comes on, the success is doubtful; but after that it almost always proves mortal.

Workers in lead should never go to their business fasting, and their food ought to be oily or fat. A glass of salad oil, with a little brandy, rum, or other spirit, is a good morning's draught; but spirits alone should never be taken while at work, nor immediately after it. Physick should be taken spring and fall, and no man should go into the cold air while hot with labour, and they should change their working-cloaths for others as soon as possible. Liquid aliment is best, such as fat broth with good meat; for low living is bad. They should now and then go a little way out of the tainted air.

If the patient is plethoric, the cure is to be begun with

bleeding, and then the *prima via* must be cleansed with a double dose of emetic wine, or emetic tartar, otherwise it will have no effect. They will even bear half a dram of glass of antimony in fine powder, with plenty of warm water during the operation. If the vomit works well upwards and downwards, the patient is in a fair way of recovery. Then a milder dose of ipecacuanha must be given with tartar emetic. If the dose does not work either way, he is generally the worse for it, and a stronger dose should be given soon after. If it vomits, but does not purge, an antimonial cathartic, or jalap and mercury should be exhibited in a larger quantity than ordinary, and then the patient should drink plentifully of warm broth. The vomits and purges should be repeated at proper intervals till the disease disappears. If they work too much, an opiate may be given at night, but with caution, for fear of rendering the patient costive, which is the worst thing that can befall him. When purgatives do not operate sufficiently, emollient, laxative, and anodyne clysters must be injected frequently to empty the guts.

#### *Of the ILIAC PASSION.*

THE iliac passion is a pain in the small intestines, apt to turn to an inflammation, in which their peristaltic motion is inverted, and their contents, and even the excrescences themselves, are voided by the mouth in vomiting. Nothing will pass downward, not so much as a flatus.

It is preceded with costiveness, which is soon followed with most sharp and violent pains, with an inflammation, distension, and a tumour of the umbilical region, which feels hard to the touch; the body is so bound, that neither wind nor excrements can pass downward: Soon after, the wind first makes its way upward, then comes on a nausea and a frequent vomiting of a bilious and pituitous matter: The breathing grows difficult, and whatever is eat or drank is soon thrown up again; reddish fæces, with a stinking smell, are afterwards forced up by vomiting: This is succeeded by loss of strength, a preternatural heat, a hard and contracted pulse, with great thirst; the urine is red, and voided with difficulty. When the case becomes desperate, a hiccup and delirium appear; the nerves are distended, the body is all in a cold sweat, and violent convulsions and fainting fits put an end to the tragedy.

In some who have been dissected, the gut seemed to be twisted; but most commonly one part of the gut enters into the other. This disease may also proceed from a rupture either of the scrotum or the groin; from poisons; from any thing that stops up the passage through the small guts, such as hard dry food, quinces, pears, unripe acerb fruit, when eaten in large quantities; to which drinking little, a sedentary life, and a melancholy disposition of mind, will greatly contribute. These all tend to harden the fæces. The gross intestines may also be plugged up with scybals; especially if a person, either through shame, or for want of conveniency, does not listen to the calls of nature.

As to the prognostics; there is hope of recovery while there is no inflammation, and while clysters are admitted

into the body, and rendered back the same way; as also while the pain shifts from one place to another, and the pain and vomiting are not continual; likewise when the disease proceeds from fæces obstructing the intestines. The hope is still greater, if laxative medicines begin to make their way downward. But if there is an inflammation, which is known from a fever, the vehemence of the pain, a suppression of urine, a hard and quick pulse, an unquenchable thirst, a tossing of the body, and extreme debility, with coldness of the extreme parts, the case is desperate. A sudden cessation of pain, and absolute want of strength, with a weak pulse, fainting fits, and a stinking breath, shew the intestines are mortified.

As to the cure; first of all it is necessary to bleed in the arm, and afterwards, in an hour or two, exhibit a powerful clyster. The smoke of tobacco blown into the bowels, through an inverted pipe, is very efficacious: This may be repeated after some time, unless the effect of the first renders it unnecessary. If the disease will not yield to this, a pretty strong cathartic is advisable.

If the patient cannot retain the cathartic, let him take 25 drops of the thebaic tincture in half an ounce of spiritous cinnamon water; and when the vomiting and pain remit, let the cathartic be repeated; if the pain returns, give the anodyne again, and repeat it every fourth or sixth hour till the intestines are easy, and the cathartic begins to pass downwards.

After the pain has been mitigated with anodynes, a cataplasm should be applied to the hypogastric region to stop the vomiting and hiccup; which may be composed of equal parts of old venice treacle and expressed oil of nutmegs, with the addition of oil of mint and camphor. This done, a gentle laxative of manna, cream of tartar, and oil of sweet almonds, may be given.

When there is an inflammation, nothing is better than six or eight grains of purified nitre, and half a grain of camphor mixed with some antispasmodic powder, and taken in a convenient vehicle. Outwardly apply a liniment of an ounce of axungia humana, [any other penetrating fat will do as well] and a dram of camphor.

But when other things fail in the cure of the iliac passion, recourse must be had to quicksilver, which sometimes has surprising effects; half a pound, or a pound at most, is sufficient, with fat broth or oil; and the patient should lie on his right side, or walk gently about the room, that its descent may be easier. But if there is an actual inflammation, the use of quicksilver should be forborne; if the patient dies, from what cause soever, the bystanders will probably affirm the quicksilver killed him.

There is no manner of danger in the use of opiates, to mitigate the pain, provided they are exhibited in the beginning, after bleeding, or before there are any signs of a mortification.

Clysters are generally very advantageous; for they relax the spasms of the gross intestines: and for this purpose warm water with syrup of marshmallows will be sufficient; and if the strength will permit, they should be injected every two hours, from the first day of the attack. They likewise restrain the inversion of the peristaltic motion, and soften the fæces.

## Of VOMITING.

Vomiting is a spasmodic, retrograde motion of the muscular fibres of the œsophagus, stomach and intestines, together with strong convulsions of the abdominal muscles and diaphragm. Those that are slight, create nausea; those that are strong, vomiting.

Vomiting generally begins with a nausea, a tension and weight in the epigastric region, a bitterness in the mouth, anxieties of the præcordia, plenty of thin saliva in the mouth, a trembling of the neither lip; to these may be added, a dizziness of the head, a sudden dimness of sight, redness of the face, a fruitless eructation; and then the contents of the stomach are discharged upwards.

Vomiting is caused by excesses in eating and drinking; by the acrimony of the aliments; by the translocation of the morbid matter of ulcers, the gout, erysipelas, and other diseases, to the stomach; from a loosens or bloody flux too suddenly stopped; from a congestion of blood in the stomach, which happens to women in the first months of pregnancy, or when there is a suppression of the menses, or bleeding piles; from sympathy, by tickling or irritating the throat or œsophagus with the finger or a feather; from the colic, iliac passion, a rupture, fit, of the gravel, worms; from poisons; from hurts of the brain, such as contusions, compressions, wounds or inflammations of the diaphragm, stomach, intestines, spleen, liver, kidneys, pancreas or mesentery; from an unusual motion of the spirits in a cart, coach, or ship; from the idea of some nauseous thing, or which has formerly occasioned sickness or vomiting; from a regurgitation of bile into the stomach.

As to the prognostics; a critical vomiting is salutary; a symptomatic bad; and that which proceeds from a subtil caustic acrimony, which vellicates the nerves, worst of all. All violent excessive vomiting is bad, as it may occasion abortions, ruptures, &c. Bilious vomiting, especially the green, porraceous, and æruginous, consisting of a corroding acid, portends danger of an inflammation; vomiting from worms which gnaw the stomach, is generally pernicious; vomiting of dead worms, if at the same time the convulsions of the limbs and other grievous symptoms suddenly cease, shews a mortification. All fœtid vomiting is a sign of internal corruption, and therefore bad.

When vomiting proceeds from crapula, late suppers, disturbed digestion by riding, and the like, it may be prevented by deep inspirations often repeated, by which the diaphragm is made to press on the stomach, and accelerate the discharge of its contents; but if an inclination to vomit, from the same causes, comes on unawares, a pretty strong and often repeated friction of the hypogastric region with the hand, will prevent it.

Pituitous vomiting, from crudities of the primæ viæ, is best cured by a vomit, and especially if there is a troublesome reaching to vomit; attended with a nausea and a cardialgia; then having first prescribed neutral salts, or squills, to incite the phlegm, give warm water mixed with unsalted butter, very plentifully, or powder of ipecacuanha.

Bilious vomiting, which proceeds from a depraved digestion, and has its seat in the duodenum, is cured by

absorbents and gentle laxatives of manna and rhubarb. When it proceeds from too great a laxity of the biliary ducts, then cortex Peruvianus, cortex eleutheriæ, and bitter tinctures and chalybeates, will be most efficacious; if from a coagulum or stone in the gall bladder, mineral waters are more likely to succeed.

When vomiting is caused by a sharp matter vellicating the nerves of the stomach, proceeding from the gout, or an erysipelas, besides giving quieting medicines, it ought to be drove back by diaphoretic powders, with a small addition of camphor. Also externally, frictions, pediluvia, and clysters, are useful.

When it proceeds from poisons, nothing is better at the beginning than drinking large quantities of milk, and fat oily things, to sheath their acrimony, and bring them up by vomiting.

Vomiting from a suppression of the menses, or from the stoppage of the bleeding piles, is cured by absorbents, by gentle laxatives, by clysters and strengtheners; and more especially by bleeding or causing the flux to return. Emetics, in this case, are as bad as poison, and either cause a vomiting of blood, or a fatal inflammation of the stomach.

Morning reachings, caused by hard drinking, are cured by absorbents and anti-acids, and by strengthening the digestive faculty, by bitters, candied orange-peel, &c.

The immoderate and frequent vomiting of pregnant women requires bleeding in the foot, and rest both of mind and body.

## Of the VOMITING of BLOOD.

VOMITING of blood is generally preceded with a tenacious pricking pain in the left hypochondrium; and the eruption itself is almost always attended with anxiety of the præcordia, and a compressing pain, as also a kind of girding on the same side. It is frequently attended with fainting fits, especially if the blood has an ill smell, or is corrupted.

The seat of this disease is in the stomach, though the spleen sometimes has a share in its production.

Persons more subject to it are the lean and slender; women irregular in their menses, and who have been hastily cured of intermitting fevers, which has brought on a suppression of the menses, and then have taken hot forcing emmenagogues; as also women about the time their menses leave them; likewise plethoric women in the time of pregnancy, and hard labour; and men of a weak constitution, subject to the bleeding piles, which either cease to flow, or flow in too small a quantity.

The danger which attends this disease, is not the same in all, though no hæmorrhage is more dangerous than this. If there is no fever, and if it proceeds from suppressed evacuations, caused by a plethora, the case is not so desperate. On the contrary, if there is a fever; if the blood is corrupted, stinking, and black; if it proceeds from a large, diseased spleen, or an indurated liver, attended with swooning; there is no hope of recovery left. It is still worse, when the stools are black; then the seat of the disease is in the ilium, from a rupture of the mesaraic vessels.

In the paroxysm, if the patient is plethoric, bleed according to his age and strength.

When

When there is an orgasm in the blood, and the pulse is impetuous and strong,

Take a pound of water, a dram of nitre, and half an ounce of syrup of wild poppies.

This, taken successively and temperately, will be very efficacious in perfecting a cure.

When the region of the præcordia, especially on the left side, is afflicted with pricking and vellicating pains, and spasmodic strictures, together with heat and thirst, emulsions will be proper. These must be made with the four cold seeds, and white poppy seed; to which must be added a little nitre, and a proper quantity of diacodium.

Likewise, in order to relax the spasmodic strictures of the intestines, and to divert the flux of the humours from the part affected, emollient clysters, frequently injected, will be proper, with a gentle stimulus, and the addition of nitre.

Outwardly, to relax the spasms and strengthen the stomach, nothing is better than the oil of camphor; which is made by dissolving a dram of camphor in an ounce of oil of sweet almonds, and then by adding twenty drops of oil of rhodium. Let the region of the præcordia and the left hypochondrium be anointed with this oil; and afterwards lay a bag on the part affected, filled with camomile and elder-flowers, with mint and wormwood, boiled in vinegar of roses or red wine pretty hot.

If blood is thrown up in great quantity, with loss of strength, ligatures made upon the joints may be serviceable, as also putting the legs and arms in cold water.

When the paroxysm is off, half a dram of rhubarb will be highly beneficial, either with or without testaceous powders; or twelve grains of compound powder of amber, with half a grain of camphor taken twice a-week, at night going to bed, in a draught of spring water. Rhubarb is a kind of a specific in opening obstructions. The patient, instead of tea, may drink a decoction of yarrow, liquorice, and fennel seeds. The common drink may be spring water, in which iron has been quenched, or acidulated whey.

If this disease proceeds from a suppression of the menfes; bleed in the foot, and give clysters prepared of mugwort, pennyroyal, wall-flowers, bay and juniper-berries, pretty frequently.

If it is caused by sharp acid liquors corroding the vessels of the stomach, then testaceous alkaline powders are proper; and starch boiled in milk will heal the vessels.

Opiates must be shunned in these cases, because they bring on great weakness and loss of strength, to the great detriment of the patient. Likewise all styptics, astringents, and vitriolic medicines, must be studiously avoided: these, indeed, will stop the eruption of blood; but then it will stagnate and putrify in the vessels, with danger of an inflammation and mortification; or at least, if the patient is cachectic, it will hasten a dropsy.

#### *Of a DIARRHOEA, or LOOSENESS.*

A DIARRHOEA is a frequent and copious evacua-

tion of liquid excrements by stool; and may proceed from aliments, or humours of various kinds, derived from different parts into the intestines.

The cause is a stimulus which irritates the viscera, occasioning the expulsion of their fluids; and may therefore proceed from the vessels of the liver, pancreas, mesentery, and intestines; when at the same time the mouths of the mesenteric veins and the lacteals are obstructed. Or there may be an extraordinary laxity of the intestinal fibres; or, lastly it may arise from a stoppage of other excretions. It is frequently attended with gripings. The patient is weak, makes but little urine, has a depressed pulse, a depraved appetite, and is sometimes feverish.

In a diarrhoea arising from sharp fermenting juices in the *prima via*, which accelerate the peristaltic motion of the intestines, the first indication is to discharge the stimulating matter; which may be effected by a dose or two of rhubarb.

At night the patient may take fifteen drops of the thebaic tincture, in two or three spoonfuls of simple cinnamon water. The rhubarb is to be repeated till the looseness abates, which is generally after the second dose.

If there is a saburra of ill-cooked matter in the stomach, a vomit will be necessary of ipecacuanha, [or an ounce of its wine]

If the diarrhoea continues to be violent, it will be proper to mix astringents with the rhubarb.

If the diarrhoea proceeds from suppressed perspiration; and if the stools are thin, and the patient feverish; first bleed, then give an emetic, afterwards a purge of rhubarb, and last of all astringents.

But the best and safest astringent of all is logwood, given in decoction.

A bilious diarrhoea ought not to be too suddenly stopped, but the humours are to be corrected gradually; for which purpose, a scruple of rhubarb slightly toasted, with a few grains of nitre, is very useful. Likewise half a dram of the expressed oil of nutmegs, either alone or mixed with a grain of opium, and given in broth, is very efficacious. The humours are likewise corrected with thin emulsions of almonds and white poppy-seeds, with the addition of diacodium.

When a diarrhoea is very obstinate, after roasted rhubarb has been given for some days, prescribe a sweat with a dram of new venice treacle, and twelve grains of burnt hartshorn, calx antimon. and purified nitre.

An habitual diarrhoea is greatly relieved by wearing a flannel shirt, and keeping the body warm.

In Vol. I. of the *London Medical Observations and Inquiries*, Dr Pye proves, by a long enumeration of instances, that in all loosenesses where emetics are adviseable in every age and sex, though the patient be in the weakest circumstances, ipecacuanha, from half a grain, to four or six grains, may be given with the utmost safety, and will seldom fail of answering the intention of the prescriber; and adds, that for many years he had experienced the great efficacy of it, in curing or assisting in the cure of diarrhoeas in children, when administered in clysters.

of

*Of the CHOLERA MORBUS, or VOMITING and LOOSENESS.*

A CHOLERA, or vomiting and looseness, is a sudden violent purging upwards and downwards, proceeding from a convulsive contraction of the stomach and intestines, caused by sharp caustic matter of various kinds.

It generally begins in August, and seldom reaches the first weeks of September, unless it be a spurious kind which arises from excess.

It discovers itself by enormous vomiting, and a voiding of vitiated humours by stool. There is a violent pain, inflation and distention of the belly and intestines, as also a cardialgia and thirst; the pulse is quick and frequent, small and unequal; there are heat and anxiety, a most troublesome nausea, sweating, a contraction of the legs and arms, fainting, coldness of the extreme parts, and the like, which kill the patient in twenty-four hours.

Though this disease is generally preceded with acid, nidorous belchings, pungent and cardialgic pains in the stomach and intestines; yet soon after, all of a sudden, and at the same instant, the vomiting and looseness make their attack. The remains of the last meal are voided first; afterwards bilious humours, mixed more or less with mucus; then those that are yellow, then eruginous, then black, often exceeding acid, and almost corrosive, together with frequent eructations and wind, and sometimes blood itself. The returns of the evacuations are very frequent. Besides, there are most acute, wringing, griping, gnawing, biting pains, with inflation and running of the intestines, chiefly above the navel, and most racking cardialgias. As the disease increases, the thirst becomes great, the extreme parts grow cold: there is a palpitation of the heart, and then hiccups; the urine stops, and the body is covered with a cold sweat. It is common for the patient to swoon away, and to fall into terrible convulsions.

There is no disease, except the plague and pestilential fevers, that kills sooner than this, especially if it attacks old persons, or children, or such as are weakened with diseases. The more caustic the matter is which is voided, the more intense are the thirst and heat, and the more certain the danger. If it be black bile, and mixed with black blood, death is inevitable. The case is as bad when there are faintings, hiccups, convulsions, coldness of the extreme parts, and cold sweats. Nor is any thing better to be expected from a stoppage of the evacuations, while the rest of the symptoms continue. But if the vomiting ceases, and the patient sleeps soon after, or the disease is protracted beyond the seventh day, he may recover; if he begins to break wind downward, it is a good sign.

This disease requires the most speedy assistance, and therefore the physician cannot be called too soon. The indications of cure are, 1. To correct and sweat the morbid matter, and to fit it for evacuation. 2. To appease the irregular spasmodic motions. 3. To strengthen the nervous parts which the disease has weakened.

Boil a large chicken in three gallons of water, that so there may be scarce any taste of the flesh and give the patient a large quantity of it to drink; or, for want of it,

warm posset-drink; and also repeated clysters of the same liquor; now and then an ounce of syrup of violets may be added to the draught or clyster. These operations may be completed in three or four hours, and then a paretic will crown the whole.

But if the physician is not called in time, and the patient has been exhausted with vomiting and purging for many hours, and the extreme parts begin to grow cold, then immediate recourse must be had to liquid laudanum in a large dose. And when the symptoms cease, it is to be repeated morning and evening, till the patient's strength returns.

Neither cathartics nor emetics, properly speaking, are of use in this disease; but the vomiting may be promoted by drinking a large quantity of warm water mixed with fresh butter or oil; and the purging by oily and emollient clysters. Or the patient may drink small chicken-broth. Whey is of great use to quench the thirst; to which may be added, the absorbent and testaceous powders.

If the patient is not too much exhausted, make him drink plentifully of warm water three or four times, to dilute and blunt the acrimony of the humours, and to bring them up by vomit: Then he must take as freely of a decoction of oat bread, baked without leaven or yeast, carefully toasted, without burning, as brown as coffee; which decoction ought to be of the colour of weak coffee. This is grateful to the stomach, and is seldom brought up again.

When the patient is much exhausted with evacuations upwards and downwards, give him a large draught of the decoction; and, when the nausea is pretty well settled, two thirds of a grain of opium, more or less, according to the strength and age of the patient.

But if the patient is convulsed, the extreme parts cold, and the pulse weak and intermitting, twenty-five drops of liquid laudanum, in an ounce of strong cinnamon water, is more proper; and afterwards a draught of any wine in an equal quantity of the decoction. After this, he may take the decoction to quench his thirst, and a little wine now and then as a cordial.

To prevent a relapse, repeat the opiate in a moderate quantity for some days, morning and evening; and care must be taken not to overload the stomach, or to eat any thing but what is of good nourishment, easy to digest, and grateful to the stomach.

*Of the DYSENTERY, or BLOODY-FLUX.*

A DYSENTERY begins with shivering and shaking, succeeded by heat of the whole body; which are followed by griping of the guts, and soon after by frequent voiding of slimy stools, attended with violent pain, and a most troublesome pressing down or seeming descent of all the bowels, and this every time the patient has a stool. In process of time the stools are mixt with blood, and afterwards pure blood is only evacuated, and the intestines are affected with an incurable gangrene. Yet sometimes there has been no blood through the whole progress of the disease.

If the patient is in the flower of his age, or has been heated with cordials, he is very feverish, his tongue is

whitish, and beset with a thick mucus; sometimes it is black and dry; he becomes excessively weak, and is quite destitute of spirits; aphthæ or a thrush appear in his mouth and throat, especially if the evacuation of the morbid matter has been preposterously prevented by altringents, and the fomes of the disease has not been expelled by cathartics. Sometimes, when a fever is absent, the gripes lead the van, and the rest of the symptoms follow.

Those, whose stomachs are loaded with much indigested matter, are troubled with a nausea, reachings and vomiting; many have an intolerable heartburn and anxiety of the præcordia. All are afflicted with a perpetual desire of going to stool, and such a violent tenesmus as is not seldom attended with a proccidentia ani.

In some, the extreme parts are cold, while the inward seem to burn, and a perpetual sense of heat and a pulsation torture the intestines. To these succeed hiccups, cold sweats, a pale countenance, wasting of the body, inflammations, and aphthæ of the fauces. At last, all pain ceases at once, the thirst vanishes, the stools come away insensibly with a cadaverous stench, the pulse becomes slender, and death is at hand. This disease is often contagious.

Prognostics. Dysenteries are dangerous to pregnant women, to old men, and to boys. There is commonly little hope when it attacks the scorbutic, the consumptive, and the cachectic; those that are weak and afflicted in mind, or troubled with worms. When it begins with vomiting, succeeded with hiccups, there is danger of an inflammation of the stomach. Nor is the case better when the stools are green, black, mixed with caruncles, and of a noisome stench. It is a fatal omen when clysters are immediately returned, or the anus so obstinately closed that nothing can be injected; for it is a sign of a palsy of the rectum. When the pulse is weak, the extreme parts cold, and the inward burn, or are without sense, nothing good can be expected. When swallowing is attended with a murmuring noise, it shews the approach of a delirium, an inflammation of the fauces, aphthæ, or a palsy of the whole œsophagus. It is necessary to know, that this disease sometimes quickly terminates, especially if there be a malignant fever, and then it kills in seven, nine, or fourteen days; sometimes it does not cease till the fortieth or upwards; when it continues a long while, it either kills the patient, or brings on a dropsy, a lientery, the coeliac passion, a tabes or hectic, which are incurable.

The common method of curing a dysentery, is first to bleed, then to vomit with ipecacuanha, afterwards to purge with rhubarb, and last of all to give astringents. Hoffman directs a scruple or half a dram of the ipecacuanha, with a testaceous powder, drinking a large quantity of warm water after it. This vomit is sometimes to be repeated. It is the modern practice, after the first vomit, to give two or three grains of ipecacuanha every eight or ten hours, in a bolus, with diascordium, or the like, with some proper julep. Hoffman would have the rhubarb given in substance, that is, half a dram in powder; Dener gives it twelve hours after the vomit, repeating it in small doses.

Mr Ray says, that the fungous substance between the

lobes of a walnut, dried and powdered, and given in a moderate quantity in wine, cured the English army of a terrible dysentery in Ireland, when all other remedies failed.

Jussieu says, a thick yellow bark, called simaruba, has been found successful in the cure of a dysentery. The dose is a third part of a quart of a decoction made with two drams of the bark. And Cramer assures us, we may depend upon the same effect from the decoction of common millet-feed, called St Ambrose's syrup, which Luther looked upon as a cure for the colic. Count Argenton took it first by his advice, merely to quench his thirst, in the manner of tea, by which means he got rid of his thirst and dysentery in twelve hours time.

Another specific is the vitrium antimonii ceratum, which has been in use for some time, but was kept a secret till it was communicated by Dr Young of Edinburgh to the public.

*The manner of preparing it is as follows:*

Take of glass of antimony in powder, one ounce; bees-wax, one dram: melt the wax in an iron ladle, then add the powder: set them on a slow fire without flame, for the space of half an hour, continually stirring them with a spatula; then take it from the fire; pour it upon a piece of clean white paper, powder it, and keep it for use.

The ordinary dose for an adult is ten or twelve grains; but for greater safety begin with six.

Never give opiates in the beginning, especially where there is great sickness; because, though opiates give relief to some, yet at other times both the sickness and purging increase the following day.

Bontius, in his account of the diseases of the East-Indies, affirms, that extract of saffron is a specific in the dysentery of those parts, even though it should proceed from poison.

#### *Of the HEAD-ACH.*

THE head-ach is a most troublesome sensation in the nervous membranes of the head, produced by various causes, and attended with different symptoms, according to its different degrees, and the place where it is seated.

The most common seat of this disease is the pericranium; a membrane which invests the skull, coheres with the muscles next the skull, and is joined to the dura mater by some fibres which pass through the sutures. It is a thin nervous membrane of exquisite sense. It may likewise be in the skin that covers the skull, and in the dura mater. This last but seldom happens; but when it does, it is very dangerous. There may likewise be a very acute pain in the thin membrane which covers the sinus of the os frontis.

If the head-ach be slight, and affects a particular part of the head, it is called cephalalgia; if the whole, cephalæa; if one side only, hemicrania; if there is a fixed pain on the forehead, which may be covered with the end of the thumb, it is called clavus hystericus.

The general cause of the head-ach is a hindrance of the free circulation of the blood through the vessels of the head.

When

When the blood rushes with impetuosity, and in too great plenty into the membranes, which may happen to the plethoric, to those whose usual bleeding at the nose is suppressed, and to young persons, there is a pain in the whole head, which becomes hot, swells, aches, and looks red; the vessels swell, and there is a strong pulsation in those of the neck and temples. The nostrils are dry and parched, there is a burning heat and drought in the fauces.

When the vessels of the head are stuffed with a mucous serum from a stoppage of the running of the nose, then there is a heavy, obtuse, pressing pain, chiefly in the forehead of the head, in which there seems to be such a weight, that the patient can scarce hold it up. Sometimes the skin is so swelled, that it will pit.

Sometimes it happens from the ferous, sharp, caustic matter of the French disease, which infects the pericranium, and often causes a caries in the skull.

Sometimes it may proceed from matter of a saline caustic nature, driven back from the external parts; as, in the gout, itch, erysipelas of the head, gutta serena; in the small-pox and measles, before the morbid matter is expelled to the outward skin, or, which is worse, when it is driven back. In these cases, when a small quantity of caustic matter causes the pain, it rather proceeds from a violent stricture of the membranes than from their distension.

There is likewise a most violent, fixed, constant, and almost intolerable head-ach, which brings on a debility both of body and mind, hinders sleep, disturbs digestion, destroys the appetite, causes a vertigo, dimness of sight, blindness, a noise in the ears, convulsions, and the epilepsy; and, by consent of the other nervous parts of the body, produces vomiting, costiveness, coldness of the extreme parts, and the countenance of a dying person.

Sometimes the head-ach is symptomatic, and attends upon continual and intermitting fevers, and especially the quartan, irregular flowing of the menses, the hypochondriac passion, and the like. A hemicrania generally proceeds from a fault in the stomach, from crudities or indigestion, and commonly appears when digestion is performed.

The head-ach is not always without danger: If the cause of the pain is within the skull, and is violent and constant, attended with a fever and want of sleep, it portends a phrensy. If it suddenly attacks the hypochondriac; or those that are prone to melancholy, especially if preceded by a violent passion of the mind, and deprives the patient of sleep and appetite, and is joined to difficulty of hearing, and an internal pulsation of the vessels, and all these without a fever, it presages madness. But when the pain in the head is sudden and very acute, with a noise in the ears, difficult walking, a weakness of the knees, an impediment and slowness in speech, it is the forerunner of an apoplexy or a palsy; in which last the pain is greater on the well side than the diseased, because the latter has lost all sensation.

The curative indications are, 1. To divert the impetus of the blood and humours from the head, and to dissipate them by suitable remedies. 2. To relax the spastic strictures of the membranes of the head, the cause of

which is a sharp caustic matter, that the fluids may have a freer circulation. 3. To correct the peccant matter, and evacuate it gently through the most convenient emunctories. 4. To prevent a return by strengthening the whole nervous system by proper remedies, and especially by an accurate diet and a suitable regimen.

When the blood rushes to the head in too great quantity, bleeding is necessary, more particularly under the tongue, in the forehead, in the jugulars, or by leeches behind the ears. If the body abounds with too much blood, it will be best to bleed in the ankle first, and the next day, or the day after, in a vein about the head. But first of all cleanse the body by any emollient clyster, or by giving an infusion of rhubarb and manna, with cream of tartar.

To restrain the orgasm of the blood, it will be proper to give a diaphoretic and absorbent mixture, with diaphoretic antimony, purified nitre, burnt hartshorn, and diacodium, diluted with a sufficient quantity of suitable simple distilled waters.

When there is an intense pain remaining fixed in one place, lying pretty deep in the membranes, the herb ranunculus, used as a vesicatory, has a wonderful efficacy. It is the upright meadow-crawfoot, with leaves like the anemone, and, if tasted, is extremely biting to the tongue. The leaves must be bruised in a marble mortar, and the part, if hairy, shaved; then a sticking plaister is to be laid on it, with a hole about the bigness of a silver penny, and the leaves over that; just in the same manner as a caustic. This is an experiment of Chesneau's: and like success may be had by mixing equal parts of volatile sal ammoniac and powder of mustard-seed, laying it on the part in the same manner.

When it is caused by a suppression of a coryza or running of the nose, a smelling-bottle of volatile salts should be held frequently thereto. Or the patient may take herb-snuff, with the addition made of flowers of benjamin and powder of cloves.

When the head-ach arises from a corrupted mass of blood and an impure serum, as in the scurvy and lues venerea; a decoction of the woods with crude antimony may be serviceable, after evacuations, fasting a day now and then, with labour and exercise, will likewise be useful; as also a sudorific.

A hemicrania, especially a periodical one, is generally owing to a foulness in the stomach and *primæ viæ*; for which gentle emetics will be beneficial, as also purgatives to derive the humours from the head; afterwards stomachics. If it proceeds from profuse evacuations of the menses or hæmorrhoids, those fluxes must be reduced within bounds.

If the head-ach is so intolerable as to endanger the patient's life, or is attended with continual watching, fainting-fits, a fever, an inflammation, or a delirium, recourse must be immediately had to opiates with native cinnabar, after a clyster has been first given.

When there is an intolerable pain in the sinuses of the nose, or the bony sinuses of the head, produced by an extravasation of some fluid, the only cure is scarification of the nostrils, or causing the nose to bleed with a straw suddenly thrust therein.

If there is an extravasation under the pericranium, and the humour is so sharp as to begin to render the bone carious, then recourse must be had to an incision, as in a whitloe.

In some kinds of head-ach, it will be proper to open the frontal vein.

When the patient's strength will not bear the loss of blood, temperate pediluvia will be beneficial, and strong frictions of the feet with a coarse cloth; as also cataplasms of horse-radish and salt laid thereto.

#### *Of the HEART-BURN.*

THE heart-burn is a pain more or less violent about the pit of the stomach, with anxiety, a nausea, and often a reaching, or actual vomiting.

The causes are, vitiated humours in the stomach, velliating and gnawing the stomach itself, or its left orifice, which the ancients call *cardia*. The stomach thus irritated, a painful sensation is excited, and spasmodic constrictions, which occasion a nausea and vomiting. But common heart-burns are generally without vomiting. The heart-burn may also proceed from wind and indigestion, and now and then from worms; but more frequently from congestions of blood about the stomach, which may happen to those who are full of blood, but more especially to the hypochondriac and hysteric, when vomiting of blood not seldom ensues.

The cure of a common heart-burn from indigestion and the acrimony of the contents of the stomach, which chiefly happens in a morning with wind, may be performed only by drinking tea or coffee, or a decoction of camomile flowers; as also by taking bitters, or a dram of powder of orange-peel, or camomile flowers, in a small glass of wine made pretty hot, and sweetened with sugar. The testaceous and absorbent powders are excellent in this case; such as the *tabellæ cardialgiæ*, or lozenges for the heart-burn, which may be carried in the pocket and taken at pleasure; about a dram is sufficient for a dose.

When it arises from a crapula, gentle emetics will be useful. If the patient begins to vomit without them, large draughts of warm water will assist to cleanse the stomach; or *carduus benedictus* tea taken freely.

If the *cardialgia* proceeds from a congestion of blood, and the painful spasms then arising, bleeding will be convenient, and emetics hurtful. If the menses are stopped, bleed in the foot.

Nor must anodyne and emollient clysters be omitted. It will likewise be proper to apply a bladder filled with a decoction of chamomile, pretty hot, to the stomach. After recovery, riding will be convenient to regain the lost strength.

If worms are the cause of the heart burn, no acrid anthelmintics must be given, but warm milk mixed with oil of sweet almonds, which, if drank in sufficient quantity, may cause them to be thrown up.

#### *Of the TOOTH-ACH.*

THE tooth-ach is caused by impure serum, which corrodes and rends the ligaments and nerveo-glandulous

coats, by which the roots of the teeth are kept firm in their sockets, and wherewith they are invested.

It is a kind of rheumatic disorder; for we have often observed that pains of the joints and shoulders have shifted to the side of the head, and have invaded the teeth and gums with violent pain. On the contrary, pains of the head and teeth have fallen into the arms and shoulders.

The seat of the tooth-ach may also be in the cavity or internal parts of the teeth themselves, that is, in the little vesicular cord composed of the nervous membrane, an artery, a vein, and a lymphatic vessel, which may either be distended by stagnating serum, or be affected with a spastic constriction, especially if the tooth is carious, and the caries reaches the said cord.

As in the gout there is a pain, redness, a tumour, and a little fever, so they sometimes appear with the tooth-ach. There is also frequently a copious discharge of saliva, which proceeds from a painful spasm, which constricts the lymphatic and venous vessels.

As the rheumatism appears in temperate, and a sudden change of weather; so it is with the tooth-ach, especially when the weather is hot and cold by fits.

The whole intention of cure consists in deriving and diverting the impure scorbutic serum from the head, and then carrying it off through proper emunctories; and afterwards in strengthening the parts.

This is to be done by saline, emollient, purgative clysters; by warm pediluvia of rain-water and wheat bran, with venice soap, and used just before bed-time; by laxatives of manna and cassia dissolved in whey or asses-milk or mineral waters. If the patient is plethoric or full of blood, bleeding in the foot will derive the humours from the head.

Sudorific remedies are also proper, but more especially an electuary made of rob of elder-berries, burnt hart's-horn, diaphoretic antimony, and a few grains of nitre, which cannot be too highly praised. Or an ounce of the rob may be taken in broth to promote a diaphoresis; and it may be used externally, dissolved in beer, in the manner of a gargle, which will yield immediate relief to the patient.

Outwardly may be applied bags, filled with paregoric and emollient species, such as elder, melilot, and camomile flowers, bay and juniper-berries, carraway and millet seeds, and decrepitated salt. They must be laid on warm, and are very safe.

A drop or two of oil of cloves, or box, applied to a carious tooth with cotton, are medicines not to be despised. Camphorated spirit of wine mixed with saffron, castor, and opium made into a liniment, and laid to the gums and hollow teeth, often gives the patient ease.

When the tooth ach proceeds from a rotten, hollow tooth, it will be best to burn the little nervous cord, which is the seat of the pain, with an actual cautery; and then the cavity may be filled up with a mixture of wax and mastich.

If this cannot, or is not permitted to be done, the only remedy left is to have the tooth drawn. But if the patient is plethoric, it will be safest to bleed first, for fear of a fatal hæmorrhage.

A small pill, made of equal quantities of camphor and opium, and put into a hollow tooth, is often beneficial. Some greatly recommend a small plaster of tacamahac laid on the side of the face, upon the articulation of the jaw-bone, or upon the temples.

But above all, the root of iris lutæa, or the yellow water flower-de-luce, rubbed upon the tooth that is painful, or the root itself chewed in the mouth, in an instant, as if by a charm, drives away the pains of the teeth, arising from what cause soever.

It is now become a practice, especially in France, upon drawing a sound tooth, to replace it in its socket; where, with proper precautions, it will fasten again. Musgrave is the first who recommends this practice. After the extraction of the tooth, he advises a gargle of honey, mixed with the juice of the herb mercury, common salt, and spring-water, and then to put it in its former place; and adds, it will become more useful than before.

The French operators have improved this hint; and when the tooth is rotten, or otherwise unfit to be replaced, they put another sound human tooth in the room of it, when it can be had; otherwise one of any other animal that is of a size suitable for the purpose.

De la Motte, in the tooth-ach, advises to make a small round sticking plaster, about the bigness of a silver groat, and to put a flat bit of opium in the middle of it, of a size not to prevent the adhesion of the other. This is to be laid on the artery near the cavity of the ear, where the pulsation is most sensible. He affirms, there are few cases that this will not relieve.

#### *Of the EAR-ACH.*

THE ear-ach is a grievous pain in the meatus auditorius, or cavity of the ears, proceeding from a sharp extravasated serum affecting the nervous membrane which lines the meatus auditorius.

This disorder frequently attacks those who are subject to rheumatic and serous desfluxions; or it may arise from a sudden suppression of sweat, or from the head being exposed to cold winds when it is moist with sweating. The cause is often an inflammation or ulcer of the ear, attended with a remarkable heat, and tensive beating pain, a redness, a fever, and even sometimes a delirium. Sometimes it is excited by worms; and then there is a wandering, cutting, gnawing pain.

The ear-ach is sometimes so violent as to cause a delirium, with the highest inquietude and anxiety, insomuch that the patients often fall into an epilepsy through the violence of the pain.

The ear-ach is sometimes a symptom of acute fevers, when the morbid matter is translated to the ear, as in the Hungaric disease, when deafness or difficulty of hearing arises. When it happens in the declension of a fever, it is a certain sign of recovery; but then the disorder is in the internal part of the ear, and the auditory nerve. When the matter is translated to the external part, then the ear-ach arises; which, unless speedily appeased, may deprive the patient of life. Those who have the ear-ach from a fall, and a sanious matter runs out of the ear, are all carried off.

The principal scope is to ease the pain, which may be

done with nitrous and cinnabarine powders, and with emulsions of the greater cold seeds; but if these are ineffectual, we must have recourse to opiates, such as the storax pills, or the thebaic tincture.

Outwardly, lay a plaster to the temple of the affected side, composed of mastic, galbanum, saffron, expressed oil of nutmegs, and opium. Afterwards let the ear be held over the vapour of milk, with the fragrant and emollient spices. Also, fill a hog's bladder with the decoction of milk of flowers of mallows, mullein, elder, mellilot, camomile, linseed, and a little saffron, and apply it to the part affected. Likewise the smoke of tobacco blown into the ear, and an infusion of millepedes in salad oil, are thought be of great efficacy when the inflammation is caused by a sharp serum.

Camphorated spirit of wine, especially with saffron, made pretty hot, and a few drops of it put into the ear with cotton-wool, is a great resolvent; it should also be rubbed into the parts behind the ear. Or oil of almonds with camphor may be used in the same manner; laying over either of them a hot bag filled with resolvent herbs, as sage, penny-royal, wild thyme, wild marjoram, camomile flowers, Florentine orris, fennel and caraway seeds, with camphor. When the patient is plethoric, bleeding is convenient.

The most violent ear-ach, from taking cold; may be infallibly cured, in a very short time, by applying the ear close to the mouth of a bellied jug, filled with a hot strong decoction of camomile-flowers.

When the inflammation will not resolve, a poultice of white bread and milk, or onions roasted under the cinders, or the like, may be often laid hot to the part affected, till it breaks, or the abscess is evident to the eye.

If the ear-ach is caused by any thing got into the ear, it will be best to relax the membranes by oil of almonds, and then cause the patient to sneeze, which forces it out.

When there is a copious flux from the ear after an abscess, the humours must be diverted by gentle laxatives, blisters, cupping, and pediluvia, if the patient is an adult. It should not be suddenly stopped by externals.

#### *Of the STONE in the GALL-BLADDER.*

THE signs of it are a fixed pain in the right hypochondrium in the region of the liver, which is constant, pressing, heavy, and sometimes acute; often attended with an ill colour in the face. The pain sometimes reaches to the epigastric region and the pit of the stomach. And the exacerbation is so great, at certain intervals, that the gripes and torture affect the whole cavity of the abdomen; joined with inappetence, a nausea, reaching to vomit, anxiety of the præcordia, cardialgic anguish, costiveness. At length, if the disease is obstinate, and will not yield to the best remedies, the jaundice supervenes. Some of these patients are continually afflicted with gripes, and live in this condition for many years, and generally die of the dropsy. Some feel a heavy, obtuse, deep, obstinate pain, with a tense weight, when the gall-bladder is greatly distended with small soft stones.

If the pain continues very intense and sharp, it draws the whole system of the nervous parts into consent, causing spastic strictures, not only of the adjacent parts, but also

of the remote; distentions of the arms and joints, epileptic convulsions, and likewise a fever with a hard quick pulse, which shews a large rough stone is firmly fixed in the biliary ducts, that will soon hurry the patient out of the world.

But nothing is a more certain sign that these terrible disorders proceed from gall-stones, than when they are voided with the excrements; and then all the symptoms cease at once, except the jaundice, which disappears by little and little, or is easily cured.

If the stones are soft, and of a light colour; or tephaceous and like mortar of plaster, they most probably proceed from the hepatic ducts: If they are rough, hard, angular, and of a deep colour, they proceed from the gall-bladder, especially if attended with most cruel symptoms in their passage through that slender canal. However, stones have been found in the gall bladder after death, which have produced no extraordinary symptoms.

There are two times of the disease, which require two different methods of treatment; in the fit, and out of the fit.

In the fit, the spasms are to be appeased with anodynes and demulcents, such as oil of sweet almonds, and fresh *sperma ceti*, internally; externally, the fat of a wild cat, or a beaver, &c.

Demulcents are, milk, sweet whey, emulsions of the cold seeds, infusions or decoctions of marsh-mallow roots, with wild poppies, elder, syrup of marshmallows.

Powders may be made with crabs eyes, cinnabar, and nitre, with a little saffron, powder of earth-worms, elks-hoofs, &c.

Externally, emollient epithems, and facculi, filled with carminative ingredients. As also lenient clysters and laxatives of manna, rhubarb, cream of tartar, and the like.

Out of the fits, opening infusions and decoctions; which resolve, discuss, and promote excretions; such as tincture of rhubarb, dog-grass, asparagus, parsley, pimpinel, afterwards adding rhubarb, terra foliata, tartar, or sal. polychrest. and syrup of marshmallows, which must be used a long while.

Some praise the roots of dog-grass, and the juice of dog-grass, as a specific.

Some use the powder of millepedes with neutral Salts.

Epithems made of camomile flowers, leaves of scordium, wormwood, and *carduus benedictus*, elder-flowers, water and red wine, used often in a day, are beneficial.

But if these fail, after long use, the only refuge is in mineral waters, among which the Pyrmont is not the least ineffectual.

These are also properly used by way of prevention, with exercise, and decoctions of the aperient roots.

#### *Of the GRAVEL and STONE.*

A NEPHRITIC paroxysm is attended with a fixed pain in the region of the loins, bloody urine, voiding of gravel or small stones, a numbness of the thigh on the side of the part affected, a drawing up of the testicle on the same side, a nausea and vomiting. After the stone is fallen into the bladder, the urine presently becomes very thick, turbid, blackish, and in great quantity.

When the stone or gravel begins to move and make its way into the ureters, then the pain begins, which is more or less sharp according to the size and figure of the stone. It is sometimes so violent, that, besides a coldness of the extreme parts, there is a nausea, vomiting, and a spastic constriction of the precordia, a difficulty of making water, a constipation of the belly, a straitness of breath, a stupor of the thigh, a retraction of the testicle to the *os pubis*, inquietude, loss of strength, a syncope, convulsion-fits, or a fatal stoppage of urine.

When the violent pain has continued for several days and nights without intermission, and has brought the patient exceeding low, attended with an entire suppression of urine, with a coldness of the extreme parts and convulsions of the tendons, it is a sign that death is at hand.

Nor is it a good sign when the stone has continued a long while in the ureter; for then the appetite decays, and a nausea and reaching to vomit supervene, till the patient is consumed with a hectic heat, and the approach of death is hastened. Sometimes the pain is attended with an inflammation of the stomach or intestines. Some, from a stoppage of urine, fall into a dropsy of the breast, a lethargy, or convulsions.

The whole intention of cure consists in the easy exclusion of the stone, and the preventing the breeding of others. HOFFMAN.

If the patient is of a sanguineous temperament, take away ten ounces of blood on the affected side; and then let him drink, as soon as possible, a gallon of posset-drink, in which two ounces of marsh-mallow roots have been boiled. Then gave an emollient clyster.

When the posset-drink has been vomited up, and the clyster returned back, give a pretty large dose of an opiate; that is about 25 drops of the thebaic tincture, or 15 grains of the pil. saponaceæ.

Also let a bath or femicupium be prepared, of a decoction of althea roots, linseed, sennugreek seeds, and chamomile flowers; to these may be added, a few white poppy heads.

In the nephritic disorder, the grand point is the evacuation of the sabulary matter lodged in the pelvis of the kidneys, or in the ureters. Bleeding serves to remove the tension and inflammation; and emollient clysters are of a double service, because, by fomenting the slender tubes, they relax the contraction, and, by unloading the lower bowels, they remove the pressure against the ureters. The warm bath opens the passage yet more, greatly relaxing the abdominal muscles, peritonæum, and intestines; the bladder is also relaxed by it, and consequently the oblique insinuation of the ureters through its several membranes is less liable to obstruct the evacuation of this sandy matter into its cavity.

By moderate diuretics, and emollient medicines, this discharge is assisted; while anodynes suspend the pain, and procure a paralytic resolution or a spasmodic contraction of the ureters, and thereby contribute not a little to open the passage.

These appear to be the most considerable methods for the relief of this disorder which is but imperfectly managed without the united assistance of all, and which, used together, seem the utmost that art can furnish.

A turpentine clyster is generally accounted very serviceable in a fit of the gravel.

Heister recommends the solution per deliquium of the fal diureticus, or the terra foliata tartari, mixed with a fifth part of the thebaic tincture, of which 50 or 60 drops may be given now and then, which will ease the pain, and gently expel the stone or gravel.

When the stone is too big to pass, the diet ought to be cool and diluent, to hinder the growth as far as possible. The diuretics that gently resolve, are parsley, fennel, scorzonera, mallows, and tea; dandelion, succory, oats, barley, honey, honey and vinegar; nitrous salts, as dulcified spirit of nitre: The most soft cooling diluter is whey; the best emollients are a decoction of marshmallows and linseed tea.

When a small stone passes through the ureters into the bladder, it is generally expelled; but if it happens to stay in the bladder, it increases by the apposition of fresh matter, or in an orbicular manner, while the original stone remains like a real kernel. These additional coats are either red, white, ash-coloured, or bluish.

The stone in the bladder may cause an inflammation, with its symptoms; as also pressures, attritions, ulcers, purulent urine, stranguries, obstructions of the urethra, an inability to discharge the urine, unless in a supine posture; a hectic fever, and a consumption. Sometimes the stone gets into the urethra, and plugs up the passage.

A stone in the kidneys may be known from a dull obtuse pain therein; from bloody urine after walking in a rough way, or after violent motion of the body, especially by being shook in a coach or other wheel'd carriage; from having voided stones formerly; and from the urine's being mixed with caruncles, pus, and filaments.

A stone of the bladder is known from a pain at the time of, as well as before and after making water; from the urine coming away by drops, or stopping suddenly when in a full stream; by a violent pain in the neck of the bladder upon motion, especially on horseback, or in a coach over the stones; from a white, thick, copious, stinking, mucous sediment; from an itching in the head of the penis; from a tenesmus while the urine is discharged; by searching, with introducing the finger in the anus, or with a catheter; as also from the effects produced by the stone before mentioned.

As to the cure of the stone in the bladder, the medicines of Mrs. Stephens were lately much in vogue as a dissolvent: and Dr. Hartley, by leaving out the superfluous part of them, has reduced them to the following form.

1. Take 2 or 2½ scruples of calcined egg-shells, thrice a day, in any convenient liquid, drinking after each dose a third part of the following decoction:
2. Take 2 or 2½ ounces of Spanish soap, and dissolve it in a sufficient quantity of boiling water; filter, and sweeten with honey or white sugar.

The powder may be taken in three or four spoonfuls of any liquor that is not acid: If the largest quantity of the decoction is taken, it will be best to divide it into four doses.

The egg-shells must be calcined in a crucible eight or ten hours, to bring it to a lime; and then be exposed to a dry air, for six weeks or two months, that is, till they

slacken or fall off into an impalpable powder, which must be sifted and put into bottles well corked.

The taking of these medicines must be continued for some time after the complaint ceases, lest any part of the stone should remain, which would be then rugged and unequal, and occasion exquisite pain afterwards.

It is common, after a few days use of these medicines, to have a great increase of pain in making water; at which time, opiates, emollients, warm baths, fomentations, a soft diet, and rest, are proper.

Dr Hales, after several trials of the different ingredients of Stephen's medicines, found that the dissolving power of them lay in the lime. And Dr Jurin, having taken soap-lees, the ingredients of which are potashes and lime, beginning with a few drops, and increasing the quantity, till he took an ounce, or an ounce and a half, every day in a proper vehicle, was cured of bloody urine, pain, &c. and passed several stones; after which he had no uneasiness. Hartley thinks the capital soap-lees are best taken in milk, half an ounce of which requires half a pint of milk. He thinks an ounce and a half, or two ounces, may be taken thus every day with perfect safety.

But Hales rightly conjectured, that lime-water alone was likely to have a good effect in dissolving the stone; which put Dr Whytt upon making experiments therewith, which have happily succeeded; whence he proposes the following method of cure.

Let the patient swallow, in any form, an ounce of Allicant soap every day, and drink three pints or more of oyster or cockle shell lime-water. If the soap be taken in pills, it may be divided into three doses: the largest may be taken early in the morning fasting, the second at eleven before noon, and the third at five in the afternoon, drinking after each dose a large draught of lime-water, the remainder of which may be drank at meals, instead of the usual liquors.

The disagreeable taste of the lime-water may be mitigated by adding a very small quantity of new milk to it; and is quite destroyed by washing the mouth immediately with a little vinegar and water, and carefully spitting it out again. A dram and a half or two drams of juniper-berries, infused in every quart bottle, will mend its taste much. But if the patient dislikes pills, let him dissolve an ounce of soap in a pint and a half of warm lime-water made of shells, which have been long exposed to the weather; and take this at three different times, drinking the rest of the lime-water by itself.

If the shell lime-water cannot be had, let him take the same quantity of stone lime-water, with at least an ounce and a half of soap, because it increases its dissolving power.

If there is an invincible aversion to soap, there is reason to think, from experiments that have been made, that oyster-shell lime water alone, taken in larger quantities, will have greater effects in dissolving the stone, than stone lime-water even when assisted by soap.

At first the patient should begin with smaller quantities of lime-water than that mentioned above, which he may increase by degrees, and ought to persevere in the use of it, especially if he finds any abatement of his complaints or symptoms of the stone's dissolving, for several months, or, if the stone be large, years; during which he should abstain from acid or fermented liquors.

For his drink, he may use milk and water, or a potion made with roots of marshmallows, parsley, and liquorice. But if he has been accustomed to more generous liquors, he may drink small punch made without acids. Spirits must not be drunk at all, nor the weak punch but very sparingly. It will be also proper to forbear the use of salt meats, honey, and acid fruits, or at most to use them sparingly. Artichoaks, asparagus, spinnage, lettuce, succory, parsley, purslane, turnips, carrots, potatoes, radishes, green pease, may be safely used; but onions, leeks, and celery, should be preferred to most other vegetables.

The patient ought to drink no more of any liquor than is sufficient to quench his thirst; and he should retain his urine as long as he can without uneasiness, that it may have the greater time to act on the stone.

If the lime water occasions costiveness, it will be necessary now and then to take a purgative; the most proper are aloe, manna, rhubarb, senna, or jalap.

Such as have a stone in the bladder, should, while they are taking the medicines, have four ounces or upwards of tepid shell lime-water injected into the bladder every day, and retain it as long as they can without pain, and should evacuate their urine immediately before injection.

Were it not for the trouble of introducing the catheter, an injection might be made at least twice a-day; and if a flexible catheter were always kept in the bladder, it might be done at pleasure, and the dissolution of the largest stone quickly procured.

That the injection of the bladder may be more safe, and attended with less uneasiness, a dram of starch may be boiled in six or seven ounces of lime-water, and just be brought to boil over the fire. The fourth part of the yolk of an egg, being mixt with six ounces of lime-water, does not weaken its virtues any more than the starch, and may be occasionally used in its stead.

Such as have no stone in the bladder, but are frequently troubled with fits of the gravel in the kidneys, may probably prevent them, by drinking every morning a pint of shell lime-water, two or three hours before breakfast; and though it may be too small a quantity to dissolve the stone, yet it may prevent any new concretions.

#### *Of the RHEUMATISM.*

THE rheumatism chiefly attacks persons in the flower of their age, after violent exercise, or a great heat of the body from any other cause, and then being too suddenly cooled, but spares neither men nor women, old nor young, especially if the person is full of blood deprived with any kind of acrimony. The disease is nearly a-kin to the gout.

It begins with chillness and shivering, followed by inquietude and thirst. Which is preceded with spontaneous lassitude, a heaviness of the joints, and coldness of the extreme parts. When the fever appears, there is an inward heat, chiefly about the præcordia, attended with anxiety. The pulse is quick and strait, the appetite is lost, and the body costive. In a day or two, sometimes sooner, the patient feels a racking pain, sometimes in one joint, sometimes in another, but more frequently in

the wrists, shoulders, and knees; frequently shifting from place to place, and leaving a redness and swelling in the part visited last. The pain is exasperated upon the least motion; it sometimes attacks the loins and coccyx.

When it seizes the loins, it is called the lumbago; and there is a most violent pain in the small of the back, which sometimes extends to the os sacrum, and is like a fit of the gravel, only the patient does not vomit. If this disease is unskilfully treated, it may continue several months or years, but not always with the same violence, but by fits. If it continues and increases, it may cause a stiff joint, which will scarce yield to any remedy.

Its proximate cause seems to be the inflammation of the lymphatic arteries, of the membranes near the ligaments of the joints, but not so violent as to bring on a suppuration. The blood is like that of persons afflicted with the pleurisy.

Take away ten ounces of blood on the side affected. This must be repeated three or four times, or oftener, once every other or every third day, according as the strength of the patient will bear.

The diet must be very thin, and an emulsion of the four cold seeds may be prescribed; and also a poultice of white bread and milk, tinged with a little saffron, may be laid on the parts affected.

If the patient cannot bear frequent bleeding, after the second or third time, give the common purging potion every other day, and an ounce of diacodium at night, till the patient recovers.

If the rheumatism begins with a febrile effervescence, temperate diaphoretics, with nitrous things, in a moderate dose, and often repeated, are beneficial; such as crabs-eyes, burnt hartshorn, amber, cinnabar, purified nitre, with diapnoic and gently anodyne waters, also citron-juice, or its syrup. The common drink should be whey acidulated with citron-juice or cream of tartar; or decoctions of the shavings of hartshorn, roots of scorzonera, succory, liquorice, or fennel-seeds.

To purge, it may be proper to chew or eat rhubarb, from two scruples to a dram, with raisins or currants.

In an incipient rheumatism of the shoulders, nothing is better than a blister laid between the scapulae.

But if the patient happens to be plethoric, nothing is better than a decoction of the sudorific woods, to the quantity of a quart a-day, for a month or six weeks together.

This last is good in the venereal rheumatism, when assisted with crude antimony and mercurius dulcis.

Young persons who are temperate livers, and not addicted to strong liquors, may be cured by a simple refrigerating diet, and moderately nourishing, as certainly as by repeated bleeding; for instance,

Let the patient live four days upon whey alone; and after that white bread may be allowed for dinner, and, on the last days of his illness, he may be allowed it for supper. When the symptoms cease, he may be allowed boiled chickens, or other things of easy digestion; but every third day he must live upon whey only, till his strength returns.

BOERHAAVE's method of cure is to the same effect, only he advises warm baths and strong blisters to be laid upon the part affected, nay, even cauteries themselves.

ARBUTHNOT says, cream of tartar in water-gruel, taken for several days, will abate the pains and swellings considerably, by its acidity correcting the alkaline salts of the blood.

RIDLEY used mercurius dulcis in rheumatic cases, as a purge, with good success, giving a scruple in conserve of violets over night, and three pints of epsum waters, evaporated away to one half, in the morning.

Dr JAMES has wrote a treatise to prove the efficacy of mercurial preparations, as well in the rheumatism as in the gout, which is supported with very good authorities.

And HUXHAM says, that the obstinate rheumatic pains, which remained after the epidemical fever of 1737, would yield to mercurial cathartics; but he preferred to every else what he calls the essence of antimony, which is nothing else but emetic wine made with glass of antimony, with the addition of a little spicy stomachic. This, given to 20 or 30 drops, operates by gentle sweats, and purges in a larger dose very mildly.

HOFFMAN likewise recommends mercurials and antimonials in particular cases; that is, when a violent and obstinate pain afflicts the lower parts of the body, about the ossa ischii and the os coccygis, and the patient is of a robust constitution, then the more powerful chemical medicines may be made use of, such as mercurius dulcis, the solar precipitate rightly prepared, or the medicinal regulus of antimony, to which a decoction of the sudorific woods may be added. From such medicines as these great relief may be expected.

CHEYNE says the hot and inflammatory rheumatisms have all the symptoms of the gout, and like it change from place to place and by over violent evacuations may be transmitted upon the noble organs. And by the way it may not be amiss to observe, that excessive bleeding, and other violent evacuations, constantly bring on a hectic or dropy on the patient in this case; diseases of a much more dangerous nature in themselves, and far more difficult to be cured, than the original one. And therefore in this disease, only promising so much bleeding as will prevent a fever and mortification, and somewhat abate the pain (which gentle doses of calomel and gum guaiacum will do more effectually; though not more speedily, than bleeding itself) the rest is to be done by large doses of the bark and Æthiops mineral mixed; and a relapse prevented by gentle doses of gum guaiacum, with antimony diaphoretic, and cinnabar of antimony.

PRINGLE observes, that rheumatisms are generally mild, though they sometimes appeared with all the violence taken notice of by Sydenham. For which reason the first sort were generally cured in two or three days by twice or thrice bleeding, and promoting a diaphoresis by the cooler medicines, particularly by vinegar whey. But if it was intended with an inflammatory swelling of the joints, sweating was improper, and the cure was only to be obtained by repeated and almost daily bleedings. But then it is to be carefully remarked, that those were afflicted with it who were best able to bear these evacuations; and in this disease he thinks frequent bleedings weaken the body less than in any other.

If the pain and swelling of the joints remain after this treatment, three or four leeches must be applied to the

part where the inflammation and tumour are the greatest, and the blood is to ooze till it stops of itself. This may be repeated freely without danger. But unless there is both an inflammation and swelling, leeches will do no service. The best internal medicines, in a true acute rheumatism, are neutral salts, with very small doses of camphor. The diet must be of the lowest kind. All outward applications are to be omitted as long as any fever or inflammation remains.

The chronic rheumatism is either the remains of a rheumatic fever, or a continuation of pains that proceeded at first from lesser but neglected colds. The blood in this case is sily. It is an obstinate disease, but bleeding is the most efficacious remedy. Eight ounces of blood is to be taken away once in eight or ten days, as long as it is sily, or the complaints remain.

Bleeding has been repeated, in many cases, three or four times, to no manner of purpose; nor would the pains abate without deobstruents, diaphoretics, purges, and anodynes. Sometimes they have yielded to the cold bath alone.

Dr Clerk of Edinburgh declares the ARTHRITIS VAGGA, or flying gout, erroneously called the SCORBUTIC RHEUMATISM, may be often distinguished by the urine of the patient; for certain filaments float in it not so transparent as the urine itself, but when taken out they appear as pellucid as crystal. They will rope to a great length, and when dried turn to a white calx. This he takes to be the morbid matter of the gout, gravel, goutish sciatica, and all true arthritic pains, distinct from the rheumatism. Soap is the best dissolvent of it yet known, half an ounce of which to an ounce may be taken in a day for a month together, if necessary, in the sciatic and other arthritic pains.

#### *Of the Gout.*

THE gout is a very painful disease, whose seat is in the joints and ligaments of the bones of the feet; the principal times of its invasion are the spring and the autumn.

In treating of this disease, we shall first give an account of the regular gout, and afterwards of the irregular.

The regular gout usually seizes the patient in the latter end of January or the beginning of February all of a sudden, and without any previous notice, unless the patient has been troubled with crudities of the stomach and indigestion for some weeks before; the body likewise may have seemed to have been puffed up with wind, with a kind of heaviness, which daily increases, till at length the fit comes on; a few days before which, there is a torpor, and as it were a descent of wind down the muscles of the thigh, with a kind of spasmodic affection of them. Likewise, the day before the fit, the appetite is more voracious, but not natural.

Though the patient seems to go to bed in good health, yet about two in the morning he is awakened by a pain which most commonly affects the great toe, sometimes the heel, the ancle, or the calf of the legs, which pain resembles that of dislocated bones; there is likewise a sensation as if water almost cold was poured on the membranes of the part affected. Soon after, a shivering and shaking supervene, with a feverish disorder. The pain which at first is tolerable, becomes more violent in proportion as the

the shaking decreases, and grows more intense every hour till night, and then it is at the height; settling itself about the little bones of the tarsus and metatarsus, whose ligaments it affects. Now there seems to be a violent extension of the ligaments, or there is a sensation of their being lacerated, or gnawed by a dog. Sometimes they seem to be pressed or squeezed together. At this time the part affected becomes so exceeding sensible, that they cannot bear the weight of the sheet, nor the shaking of the room by a person's walking about.

The patient is now in great torture, and is continually shifting his foot from place to place in hopes of ease. His body likewise is in as constant agitation as the part affected. This always happens at the accession of the fit, but the pain continues without remission till two or three in the morning, that is, twenty-four hours from the first onset, at which time he begins to be at ease, which he is willing to attribute to the last posture in which he placed the affected member. Now he falls into a gentle breathing sweat, and gets a little sleep, and, when he awakes, perceives the part to be swelled, and the pain much abated; for before, the veins of the member, being turgid, were only more conspicuous than usual.

The next day, or perhaps two or three days afterwards, if the gouty matter is copious, the part affected is a little in pain, which grows more violent towards the evening, and abates at the crowing of the cock.

In a few days the other foot begins to be affected in the same manner; and, if the pain has ceased in the first, the weakness which is left behind soon vanishes. The same tragedy is now acted over again. Sometimes, when the gouty matter is in great plenty, it attacks both feet at once, but it generally seizes one after the other.

After both the feet have been tormented, the fits which follow are out of rule, both as to the time of invasion and the duration; only the pain grows more intense at night, and remits in the morning.

From a series of these small fits arises what is called a fit of the gout, which is longer or shorter, according to the patient's age. For it is not to be supposed that, when a patient has been laid up with the gout two or three months, that it is a single fit, but rather a series or chain of small fits, which continually grow shorter and milder, till the peccant matter is at length consumed, and the former health restored. This happens to the more vigorous, and whom the gout seldom visits, in fourteen days; to persons advanced in years, who have often felt its rage, in two months; but those who are debilitated with age, or the long stay of the disease, it does not leave, till summer, being pretty far advanced, drives it away.

For the fourteen days the urine is higher-coloured, and deposits a sediment like gravel, and not above one third of what the patient drinks passes off by urine; the body on the first day is costive, the appetite decayed, there is a shivering towards the evening, as also a heaviness and troublesome sensation in the parts not affected. When the fit goes off, there is an intolerable itching in the affected foot, chiefly between the toes, from which and from the feet fall branny scales, as if the patient had swallowed poison.

The disease thus terminated, the patient's good habit

of body and appetite return in proportion to the severity of the pain in the last fit; and in the same proportion the next fit will be either accelerated or retarded; for, if the last fit was very severe, the next will not come on in less time than a solar revolution.

Hitherto you have an account of the regular gout, and its genuine phenomena; but when it is disturbed by incongruous medicines, and the patient is worn out by the long continuance of the disease, it becomes irregular, and the substance of the body is as it were changed into a fomes of the disease, and nature becomes unequal to the task of conquering the malady thus changed, in the accustomed manner.

The feet were at first the seat of the disease, but now it attacks the hands, wrists, elbows, knees, and other parts of the body. Sometimes it so distorts the fingers, as to make them resemble a bunch of parsnips, and at length stony concretions appear about the ligaments of the joints, which, breaking through the skin, resemble chalk, or crabs eyes. Sometimes the gouty matter invades the elbows, and creates a whitish swelling of the size of an egg, which soon assumes a red colour, and becomes inflamed. Sometimes it affects the thigh in such a manner, as if a great weight was hanged thereon, and yet without any remarkable pain. From thence it descends to the knee, which it handles more roughly, hindering all motion, for the patient continues in the same place and posture as if he were nailed to the bed.

Now the gout afflicts the patient all the year, except two or three months in summer; and the particular fit, which did not last above a day or two, continues ten or fourteen days; and the first or second day after the onset, he is disturbed with sickness as well as pain, and a total loss of appetite.

His limbs also begin to be contracted and unapt for motion; and though he can stand, and perhaps creep about a little, yet so slowly, that you can scarce perceive he gets forward at all. If he strives beyond his strength, hoping by exercise to regain his legs, and to become less susceptible of pain, the fomes of the disease will attack the viscera in a more dangerous manner. The urine is like that of a person troubled with a diabetes, and there is a troublesome itching in the back and other parts, especially at bed-time.

Nature being at length oppressed with the disease and old age, the fits begin to grow more mild, and, instead of the usual pain, there is a kind of sickness, with a pain in the belly, a spontaneous weariness, and sometimes a disposition to fall into a diarrhoea; which symptoms vanish as often as the pain returns to the joints. And thus, the patient being alternately afflicted with pain and sickness, the paroxysm becomes very long and very tedious.

This disease seldom invades any patient till he is upwards of thirty, and men are more subject to it than women; as also persons of acute parts, who follow their studies too closely, especially in the night, with an intense application of mind. Likewise those who live high, and indulge their appetites, drinking plenty of rich generous wines; or who use acids too freely, or white eager wines; or who have been addicted too early to venereal pleasures; or whose bodies are large, gross, and full.

Those

Those also are liable to it, whose sweaty feet are too suddenly chilled; or who suffer their feet to sweat in wet shoes and stockings. Hence hunting and riding in the cold are pernicious. It may likewise be received by contagion, and is hereditary, descending from father to son.

The curative indications require, first, that the primæ viæ be set free from a load of indigested crudities. and the viscera be restored to their pristine vigour: that by these means the aliments may be duly concocted and assimilated into healthy fluids, and such as will pass freely through the smallest vessels; while whatever is unfit for nourishment may pass off by perspiration, in due time and quantity. Secondly, that the fluid stagnation in, and stuffing up the smallest vessels, may be expelled the body, and a free passage through the contracted vessels be restored.

The first intention may be answered by vomits and gentle cathartics, repeated as occasion requires; by bitters, aromatics, antiscorbutic medicines; by alkaline fixed salts, taken in small quantities for a long time; by aliments and drinks that are nourishing, light, easy of digestion, quickly assimilated and taken in due quantity; by powerful exercise often repeated and long continued, and especially by riding in a dry, pure, serene air; by friction, by motion of the affected parts, by going to sleep at early hours.

The second intention may be answered partly by the preceding article, as well as by procuring gentle sweats, by bathing in natural and artificial baths; by sweating in a bagnio; or by the use of volatile salts, and copious drinking of attenuating liquors actually hot, in the morning while in bed, in order to procure a sweat; as also by mercurial purges, taking a large quantity of di-luents after them: by frictions of the whole body, especially the parts affected, with hot, dry linen cloths, till a redness appear; by cold baths, and the like. These things being used with prudence, and according to the various temperaments of the patient, will yield no small relief, even in the nodous gout itself.

As the proximate cause lies in the vitiated state of the smallest nervous vessels of the body, and of the fluid that passes through them, it is no wonder that bleeding will not reach the matter, state, or cause of the disease: yet it may sometimes do good by accident, by causing a small revulsion, and by abating the urgent symptoms.

Nor will emetics or cathartics yield so much relief as is commonly thought, because they often raise a disturbance in the nervous fluid, diminish the other fluids, and weaken the expulsive faculty. But much greater benefit may be expected from sudorifics rightly administered.

Nothing is more fatal than to hinder the gouty matter, now grown mature, and remaining unexpelled, as well as uncorrected by proper medicines, from falling on the usual parts, which indeed cause great pain, but no danger. If it invades the brain, it will occasion apoplexies, palsies, a delirium, weakness, dozing, tremors, or universal convulsions: If it attacks the lungs, it produces an asthma, a cough, or a suffocation: if the intercostals and pleura, a convulsive pleurisy; if the abdominal vi-

scera, nausea, anxieties, vomiting, belching, gripings, or spasms of the viscera. It is almost incredible how many diseases it creates, which are suddenly mortal; or at least not to be cured but by reviving the fit of the gout, which had been disturbed, and rendering it as severe as possible.

These last mentioned evils happen from injudicious applications of narcotics, refrigerants, astringents, or in-craassants; or from medicines which cause a revulsion from the diseased part, or from debilitating, evacuating, or suffocating remedies. Hence bleeding, purging upwards or downwards, plasters, poultices, of the nature above-mentioned, and all opiates, produce these effects; as also a spontaneous weakness brought on by extreme old age; or from the extreme parts being so obstructed, corrupted, withered, or perished, that the morbid matter cannot pass through them any longer.

To abate the excessive pain in the part affected, if there be an absolute necessity, opiates may be given internally, and the patient may drink plentifully of hot whey, or any other liquor of the like nature. External emollients and anodynes may be used laid on pretty hot, or the part affected may be beat with nettles, or it may be anointed with terebinthinated balsam of sulphur, or tow may be burnt thereon.

Though there is nothing of any moment to be done in the fit, yet it will be proper to abstain from flesh for some days, and to live upon water-gruel, or such like diet; but no longer than the stomach is averse to flesh, for fear of bringing on a disturbance of the animal spirits; but then great care should be taken in the diet, both as to quantity and quality.

As soon as the pain is almost gone, and the swelling and the weakness only remain, nothing can be better than warm stomachic and spicy purges, dosed and repeated according to the strength of the patient. This being premised, if the patient's strength is impaired, and his flesh wasted, give asses milk with pearl, half a pint or a pint in a morning early, and at five or six o'clock in the afternoon; and to keep up the appetite which the milk commonly palls, and to prevent its cooling effects on the stomach, a light bitter made of gentian, cinnamon, and orange-peel only, the last double to the other two, infused in sherry or white wine, and taken two hours before meals, may be used most conveniently. This course may be continued two or three weeks; after this a course of Bath or German-spaw waters with steel, riding, a light white food diet, and generous wine drank temperately, will be most proper.

Out of the fit, those things are most proper which promote the concoction of the aliment, whether by medicines, exercise, or diet.

In the diet there is a medium to be observed; the patient should neither eat more than the stomach will digest, nor be so abstemious as to defraud the parts of such a proportion of aliment as is necessary to maintain the strength and vigour. As to the quality of the food, the patient's palate is to be consulted: but he should dine upon one dish of meat only; for several kinds of flesh, eaten at the same meal, disturb the digestive faculty more than the same quantity of any one sort. As for other things,

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The patient may feed upon what he likes best, provided it is not sharp, nor salted, nor seasoned with spices. He should eat no supper; but instead thereof should drink a draught of good small-beer, whereby the breeding of the gravel may be prevented. If the patient is troubled with the gravel or stone, and makes bloody water, he may purge with manna once a week, and take a pargoric at night.

The most suitable drink is such as is not so strong as wine, nor so weak as water, for the latter by its coldness will deprave the stomach. Of this sort is the London table-beer, or water with a little wine. But, when the gouty matter has seized the whole body, he must abstain from all fermented liquors, though ever so mild and small.

But if the patient has been used to strong or spirituous liquors, or is advanced in years, or through weakness cannot digest his aliment, he may, at meals, indulge himself with a draught of Spanish wine, which is better than French.

Regard must likewise be had to the symptoms, which, in the fit, endanger the patient's life. The most common is a weak and languid stomach, attended with sickness and gripes, as if from wind. In this case nothing is better than a glass of Canary drank now and then, together with exercise. But, if the symptoms will not admit any truce, give twenty drops of the thebaic tincture in spirituous alexitereal water, provided the head is not attacked, and let the patient compose himself to rest.

If the nephritic pains should come upon the gout, which often happens, let the patient omit all other medicines, and drink a large quantity of posset-drink, in which the leaves and roots of mallows and marshmallows have been boiled. Then let a clyster be given, and afterwards a large dose of laudanum.

When the gout has seized on the head, it is to be treated as any other head-ache, or as an inflammation of the brain and its membrane; bleeding in the arm or jugular, cupping on the back, and blistering between the shoulders, but especially on the ancles, to give the gouty humour a vent downwards. In young and strong constitutions mercurial and antimonial vomits will do wonders. Likewise gentle stomach purges are to be poured down continually, that is, two or three spoonfuls every third hour, till the effect is obtained.

Mercurial vomits are not only proper for the gout in the stomach, but they are absolutely necessary as well as mercurial purges, when the gout becomes fixed to, and permanent in a place, as also when it is dispersed all over the habit like a rheumatism. These active medicines must first render the humours fluid, which gum guaiacum, with diaphoretic antimony, persisted in, will afterwards carry off.

#### *Of the SCIATICA, or HIP-GOUT.*

THE sciatica is a violent and obstinate pain in the hip, chiefly in the joint where the head of the thigh-bone is received into the acetabulum of the coxendix. The pain will sometimes extend itself to the lower part of the loins, to the thigh, leg, and even to the extremity of the foot; yet, outwardly, there is no swelling, no inflammation, nor change of colour in the skin.

Sometimes there is such a spasm of the muscles on the side affected, that the patient cannot stand upright, without the utmost pain.

When the sciatica has continued very long, there is such a collection of pituitous humour in the cavity of the joint, that, by relaxing the ligaments, it often causes a luxation. Sometimes it causes an aridura, or wasting away of the adjacent parts.

When the pain leaves the hip, and moves downwards, it is a sign that the spasms are resolved. A violent motion of the body generally exasperates the pain.

After a gentle cathartic, or clyster, bleeding will be proper, especially in the ancle; also leeches applied to the hæmorrhoidal veins have been found beneficial. Strong purges are hurtful; but mercurius dulcis given with scammony, or some other purgative, will be of service.

If the patient is old or weak, lenient purges will be most proper; and on the intermediate days a dose of calomel, which is afterwards to be purged off; and so repeated alternately for some time.

Baglivi observes, that if nothing else will do, in pains of the external parts, recourse must be had to caustics, particularly the leaves of ranunculus, or a mixture of quicklime and soft soap, which are beneficial in the hip-gout.

Cheyne observes, that when the gout is dispersed over the whole habit, or is fixed and settled on a particular joint, mercurial vomits and purges are necessary to dislodge it; but the sciatica will not yield to this, and but rarely to any other methods of use; but, by the following method, a perfect cure may always be obtained, if the distemper is a genuine sciatica, though of many years standing.

It consists in taking one, two, or three drams, to half an ounce, according to the strength of the patient's stomach, of the ethereal oil of turpentine; which is that which comes off between the spirit and the oil in drawing off the common oil of turpentine; this is to be taken in triple the quantity of virgin honey, in a morning fasting, for four, five, six, or eight days at farthest, intermitting a day now and then, as the patient's occasions require, or his stomach suffers by it. Large draughts of sack-woy must be drank after it, to settle it on the stomach, or carry it into the blood; likewise every night must be taken a proper dose of Matthew's pills [or half a scruple of the *pil. saponacea*] that is, if the oil has been taken in the morning.

To remove the grosser remains and strengthen the weakened part, the patient must take a dram or two drams of flower of brimstone, for some time twice a day, in a tea-cup full of milk. If through great intemperance, or a violent cold, the patient relapses, let him repeat the former medicines for a day or two. Then, to strengthen the *prima viæ* and enliven the spirits, let him drink the Bath or Spaw waters with steel, and bitters with volatiles.

#### *Of a Virulent GONORRHOEA.*

A VIRULENT Gonorrhœa, or CLAP, proceeds from impure coition with an infected woman.

This distemper begins and makes its progress in the following manner. The patient, sooner or later, according as the woman with whom he has had conversation was

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more or less infected, and according to his constitution, by which he may be more or less disposed to receive the infection, is first seized with an unusual pain in the genitals, and a kind of sensation like a rotation of his testicles. Afterwards, if the prepuce constantly cover his glans, there appears an eruption or pustule, which by its size, colour, and figure, resembles a spot of the measles; presently after appears a weeping matter like semen, which daily changes colour, and becomes more purulent and more yellow, till at length, if the disorder be highly virulent, it assumes a greenish hue, or appears like a thin sanious matter mixed with blood.

The pustule at length becomes an ulcer, commonly called a chancre, at first not unlike the thrush in children's mouths, which, daily eating deeper and wider, at last is encompassed with hard and callous lips.

Those whose glans is uncovered, seldom have such a pustule, either because it is hardened by being continually exposed to the air, or by the frequent rubbing of the shirt, and so is less liable to imbibe the infection.

The running brings on a heat or smarting in making water, which is most violent when it is over, for then it seems to burn the whole duct of the urethra.

Another symptom is the cordee, or contraction of the frenum, by which the penis is bent downwards. There is likewise, when the penis is erected, great pain as if compressed transversely with a strong hand. This chiefly happens in the night, when the patient is warm in his bed.

Sometimes the urethra being eaten and excoriated with long running of the acrimonious pus, nature breeds a soft spongy flesh, to supply the defect, which daily increasing forms caruncles or carnosities, so far as to plug up the urinary passage and stop the urine. However, the little adjoining ulcers continue to pour forth a kind of an ichor; and this state is not only troublesome to the physician, but almost as bad as death to the patient.

It also often happens, through some violent motion, or the ill-timed use of astringents, that the sanies which should be carried off by the gonorrhœa, is translated to the scrotum, and causes one or both of the testicles to swell and inflame with intolerable anguish and pain; the running at the same time decreasing, while the scalding of the urine is as great as ever.

To these symptoms may be added the phimosis, which happens when the prepuce cannot be drawn back to uncover the glans; but this the case of many in a healthful state. Also the periphimosis or paraphimosis, when the prepuce, being swelled, cannot be brought forward to cover the head of the penis. There are sometimes also watery bladders or vesicles called cystallines, and at length buboes or swellings of the glands in the groin. When these last appear, the lues venerea is generally supposed to begin.

Women are not subject to such a variety of symptoms as men; their chief complaints being a difficulty of urine, and a running; however, they are liable to chancres and venereal warts as well within as on the outward parts of the labia pudendi, as also to buboes in the groin. As for the coarctation of the sphincter vaginæ, pursuing up as it were the external orifice, this is not a phimosis, though by some improperly so called.

The cause of a virulent gonorrhœa is a taint by impure coition, conveyed from a woman infected with a malignant gonorrhœa, or the lues venerea, first to the genitals of a man, and afterwards through the pores to the lymph or feminal liquor; the due crasis and natural mixture it entirely destroys, by inducing partly a caustic and corroding, and partly a putrid state thereof. Hence arise the pains and heats, the tumours, the inflammations, and the exulcerations of the genitals: For at first the glans is only affected, whilst, in coition, the poison insinuates itself into the open pores. Then it soon proceeds to the glans of the urethra, then to the prostata, which are porous, and afterwards to the vesiculæ seminales.

If the infected lymph is conveyed to the inguinal glands through the lymphatic vessels, which Cowper discovered to run from the prepuce to the groin; then a venereal bubo is formed, which is a hard tumour without pain. But if the seat of the gonorrhœa is deeper, and an inflammation arises at the beginning of the urethra, where the vesiculæ seminales discharge the feminal fluid, then these vessels are so compressed by the tumour, that the semen cannot be conveyed to them from the testicles, whence it happens that the testicles swell.

As to the prognostics, we must observe, that the greater the infection is, the more violent and obdurate the disorder will prove; though it seldom brings on a pox unless the discharge is imprudently stopped by the preposterous use of sudorifics and astringents; for, immediately on the suppression of the discharge, buboes, tumours of the scrotum and testicles, caruncles of the urethra, and other terrible symptoms appear, together with a confirmed pox. The more regular the discharge is made, the more mild all the symptoms are.

But when the running is small in quantity, the urine is highly seid, and the matter yellow or green, it is a bad sign.

It is a certain sign the disorder is mitigated, when the painful constriction of the penis in erection, and the heat of urine, are removed; as also when the impaired strength begins to return, and the countenance, which before was pale, assumes a florid or a natural colour.

It is a sign the gonorrhœa is cured, if, upon compressing the penis, a drop or two of thin limpid liquor, like the white of an egg, is discharged.

The regimen, during the time of the cure, requires the patient to abstain from all oily food; and he must also avoid every thing which by its acrimonious quality stimulates to venery; such as spices, bulbous roots, flesh, eggs, fish, and fermented liquors; for the inflation of the penis retards the cure. This is of the utmost consequence; and therefore all venereal incitements, such as obscene books, and whatever else inflames the fancy, should be shunned like death.

Water and whey are the best drink, and seeds and summer-fruits the best aliment.

All possible care must be taken that cold never reach the penis; and that it be kept always moist, lest the pores contracting repel the flux of matter. An emollient and somewhat antiseptic cataplasm will be beneficial.

In the place of mercurials given internally, Astruc directs

rects the use of crude quicksilver, as in the common unction, to be rubbed upon the parts, as about the body of the penis, especially under the urethra to the perinæum, and so up to the pubes and testicles.

Turner approves of this method in all local affections, such as chancres, a phimosis and paraphimosis from a venereal taint: As also when there is a callosity in the urinary passage, or an induration of the testicles, particularly their epididymes, left after the hernia humoralis, and the like. Nor does he disapprove of it in common claps during the course of the purgation.

If there is no discharge of virulent matter from the penis, it is called gonorrhœa sicca, or a dry clap, the symptoms of which are a dysury or difficulty of making water, and after, from the increase of the inflammation and tumefaction, an ischury or total suppression of urine.

In the cure of the dry clap, Astruc advises plentiful bleeding in the beginning, to take off the tension, and to abate the inflammation; as also emollient decoctions of mallows, linseed, &c. in milk, to foment the parts; but perhaps it might be better to make a poultice of these ingredients, after Boerhaave's method, to lay to the parts affected; or, which is best of all, to use them one after the other.

He likewise advises lenient clysters, cooling emulsions, and ptisans with sal prunella and anodynes between whiles. During the continuance of the inflammation, no mercurials must be used; and if the symptoms increase, threatening an abscess outwardly in the perinæum, it is to be forwarded as much as possible by suppurative poultices, and the matter discharged.

#### *Of the Cure of the SYMPTOMS.*

##### *I. Of the HERNIA HUMORALIS, or Swelling of the Testicles.*

ASTRUC, in the cure, recommends frequent bleeding, and an antiphlogistic regimen, and fomenting the parts with a decoction of mallow-roots and linseed; or milk pretty warm; or an anodyne cataplasm of lily-roots, with leaves of henbane, mallows, and branc urine, boiled to a mucilage, and mixed with the flower of linseed and oil of lilies. After the inflammation and fever are abated, he advises a gentle purge; after mild resolvents externally, and antivenereals internally.

The hardness of the epididymes is to be dissolved by fuccinated balsam of sulphur, mercurial plasters, and ointments. During the use of these applications, a suspensory bandage should not be neglected.

When pus is formed in the testicles, it must be discharged with a lancet. If it should leave a fistulous ulcer, he advises a mercurial ointment.

##### *II. Of a BUBO.*

ASTRUC asserts, that venereal buboes are of two kinds: the first is essential, happening immediately after coition with an infected person; the second symptomatical, which follows the suppression of the gonorrhœa, or the drying up of the ulceration. He likewise mentions a third, which does not appear so early as the other two, and is therefore a pathognomonic sign of a lues venerea or pox.

He proposes to cure it by mercurial purges, to carry off the humour; in the mean time rubbing a mercurial ointment into the part, to dissolve the induration; which he thinks is more gentle and easy, than to promote the suppuration by ripening poultices, and then opening the tumour by a caustic, giving mercurials inwardly at the same time.

De Salt cures all the symptoms by rubbing into the parts a strong mercurial ointment, causing the patient to anoint himself from the anus all along the urethra to the glans and prepuce. The following day he gives a strong dose of jalap, that is, from two scruples to a dram. His diet drink is to be spring-water in which mercury revived from cinnabar has been boiled. If the patient cannot bear much purging, he may have a truce for a day or two, but the ointment is to be continued every night. The first friction gives considerable relief, the second yet more, the third commonly makes the pain cease, and the fourth and fifth generally silence the complaints. Five or six weeks generally perfects the cure.

In buboes, the patient is to rub the ointment into the groin, scrotum, and parts in either sex; purging every day, and drinking the mercurial water; by which means the buboes melt away, the phimosis, paraphimosis, and chancres disappear, and the former health returns. If there is matter already formed in the bubo, then he allows it must be opened. Heister's method is much the same.

##### *III. Of Caruncles and Carnosities in the Urethra.*

THE obstacles which hinder the free passage of the urine, according to Astruc, are these which follow. 1. Ulcers in the urethra. 2. Cicatrices left behind after the healing these ulcers. 3. Caruncles. 4. A schirrus on the verumontanum, or caput gallinaginis. 5. Indurations of the prostate and vesiculae feminales. 6. Carnosities rising in and straitening the canal.

He proposes to cure the ulcers by the same regimen as the first period of a gonorrhœa, viz. by repeated bleedings, lenients and refrigerants, to abate the fluxion, and take off the inflammation.

Turner, in the worst cases, would not have the urethra laid open, but only have the perinæum well greased with the mercurial liniment, by which he has known many large callosities insensibly dissolve, while the candle or leaden probe, smeared also therewith, has been kept within.

But there has been lately introduced into practice by Daran a new method of curing these disorders with bougies, the composition of which he keeps a secret.

According to him, if the canal of the urethra be open enough to admit the extremity of the bougie, a suppuration will ensue from the diseased part of the urethra, which will in time relax and open the stricture; or, if the stricture opposes the entrance of the bougie, yet still the mere point of the bougie will suppurate it in a small degree, and by and by, though much more tediously than in the other case, by relaxing, open it.

The first discharge procured by a bougie is generally very sanious, and evidently flows from the place where the obstruction is, that part of the bougie only being covered

covered with matter that answers to the obstruction. Again, the cordee, excited by the use of the bougie, is infinitely more painful where the obstruction is, than in the other parts of the penis. It will, it must be owned, produce a cordee in a sound penis; but then it extends through every part of it, and is by no means so painful as the other.

If the symptoms of the strictures, callous scars, caruncles and tumours of the corpus spongiosum urethrae are essentially different, those differences are not mentioned by any writer; except that, when the urethra only is affected, the patient, in making water, voids matter before his urine; but when the prostate glands or vesiculæ seminales only are concerned, matter follows the last drop of urine. But it frequently happens that one is complicated with the other.

The properties requisite in a bougie, are a sufficient degree of firmness, that it may be introduced with some force: A suppleness and tenacity, that it may conform to the motions of the body without breaking: A lenient suppurative disposition, to bring on a discharge without pain: And, lastly, a smoothness of surface, that it may not only be introduced with more ease, but that it may lie easy in the passage till it begins to dissolve.

That chiefly made use of is as follows;

℞ *Emplast. commun. cum pice Burgund. ʒij. Argent. viv. ʒj. Antimon. crud. pulv. ʒβ. M.*

The *emplast. com.* or diachylon, must be made with oil and a little Burgundy pitch added to it, to render it sufficiently tenacious: the antimony must be finely levigated, that it may give a smoothness and good consistence to the bougie.

The quicksilver, whether it be divided in *bals. sulph.* or honey, must not be put into the plaster till the moment before the bougies are made, nor must the plaster be boiling hot at that time. When the quicksilver is mingled with the plaster moderately hot, slips of fine rag must be ready to dip in the composition. They must be of different lengths, from six to nine or ten inches, and about three inches broad. Roll them up loosely, and, taking hold of one extremity with the left hand, let it fall gently on the surface of the plaster, and then draw it out gently. As it is drawn out, it will unroll, and take up a quantity of the plaster upon its surface, equal to the thickness of a silver groat. It may be proper to assist the unrolling with a spatula. The plaster must be hot enough to soak through and discolour the rag. The ladle in which it is melted ought to be broad and flat at the bottom; and the plaster must be kept stirring to preserve it in equal consistence. The bubbles on the surface of the cloth may be smoothed with an iron spatula a little warmed.

One rag will make six bougies of a moderate size; they are best cut with a knife and ruler. They should be made taper at the end, by cutting off a slope about an inch and a half long. When they are rolled up, it must be with that side outward which is covered with plaster; and they must be first rolled up with the finger and thumb as close as possible, before they are rolled upon a board or marble. In the winter it will be proper to hold them a little before the fire to facilitate their rolling.

Before a bougie of any kind be introduced into the ure-

thra, it will be necessary to smear it with sweet oil, that it may go in easily, and not stimulate too much at first. The patient may either stand or lie down in the posture of being cut for the stone; then the surgeon must grasp the penis near the glans, and extend it gently, that the urethra may not be wrinkled, and then it will meet with no impediment but what is occasioned by the disease.

It often happens at the beginning, that the bougie cannot be too small; and then the end must be round, that it may readily slip over the plicæ of the urethra; it is also exceedingly desirable that it enter within the obstruction. However, it is necessary to desist from pushing it when once it begins to bend. When it meets with any resistance, to avoid the bending, turn it round with your finger and thumb several times, and, as you turn it, press it a little forwards. If by this method it advances, continue to do the same thing till it stops. But it must be owned that the operator in this case may be easily deceived.

The bougie must be confined in the penis by some kind of bandage, or rather we may keep it fixed in the urethra by a cotton string tied about its extremity, and then passed round the penis; no other thread is necessary.

When the patient is timorous, or the part tender, it may be left in two or three hours in a day only at first, but otherwise six or seven. When the patient finds he cannot bear it, it may be discontinued two or three days, according to the nature of the symptoms.

There are instances of its having first cured, and then brought on a fresh strangury. In this case, forbear its use for two or three days, and the strangury will cease.

Some have been able to wear it night and day without intermission; and as they withdrew one, introduced another. And this is a prudent step; for the more suppuration is procured, and the longer the urethra is kept distended, the cure is more likely to be radical. When this cannot be done, the day is better for its use than the night, because in the night it is more subject to erections.

Two bougies in a day generally answer the purpose; one in the morning, and one in the evening, as more suitable to the patient's avocation; though some can walk about with them.

If the testicles should inflame, or any feverish disorder come on, they may be kept in an hour, or half an hour in a day, to prevent the urethra from contracting again till the symptom is removed; to prevent these disorders, the patient should observe a cooling regimen during the treatment.

Some are relieved by the bougie in a few weeks, some not till many months. Generally the cure may be performed in seven, eight, nine, or ten weeks. This is known by the removal of every symptom of the disorder; for some degree of running will generally continue as long as the bougie is employed.

When the patient judges himself well, it will be best to desist gradually, wearing it at first only an hour or two in a day, and then two or three times a week, after which it may be entirely left off. If any gleet still remain, or any obstruction threatens to return, it will be necessary to use the bougie four or five weeks longer.

In suppressions of urine it will be always advisable to introduce the catheter if possible, and indeed to keep it

in the bladder two or three or four days; after which, the canal will perhaps admit a bougie, and then, a suppuration being once procured, it may easily be preserved open.

#### IV. *Of a GLEET.*

IN what manner, says SHARP, a gleet is furnished, cannot well be determined, without first ascertaining the exact seat of a gonorrhœa. That the lacunæ of the urethra are usually ulcerated in a gonorrhœa, is now generally assented to. Yet though all allow the existence of ulcers during that disease, they will not admit that a gleet is the discharge of an ulcer.

But it is most probable, that the running is not all of it a purulent matter, but partly matter, and partly a discharge from the secretory organs, as also from the vesiculæ seminales, when they or their ducts are affected. For the running is produced in less time after the infection than is requisite for the formation of matter in every other instance; and the appearance of matter is frequently the first alarm in a gonorrhœa, the heat of urine and other symptoms of an inflammation and ulceration following sometimes two or three days after.

For these reasons, it is supposed, that the venereal poison, in its first operation, irritates only, and thereby increases the secretion; especially as the same thing happens to the glands of the intestines from purgatives, from the salivary glands, from smoking, &c. As the poison operates more strongly, the inflammation increases, and the ulcers form and extend, when not only the matter from the ulcer is sanious, but all the secretory vessels communicating with the ulcerated lacunæ separate a thinner fluid than usual; and both the matter and secreted fluids continue to be thin so long as the inflammation is violent.

It is even possible that in some slight gonorrhœas, which disappear in a few days, the venereal poison may not have activity enough to bring on an ulceration of the urethra, but only a mere irritation of the lacunæ. Besides, in other cases, the quantity of the running is generally much greater, if we may judge by analogy, than a few ulcers in the urethra could possibly furnish. Of this we have almost ocular proof in women; for, though the gonorrhœa be exceeding plentiful, yet, upon the nicest inspection, we often cannot find the least degree of ulceration of the vagina, though, if the discharge was purely the digestion of ulcers in that part, it is likely some few of them may be visible.

When the inflammation ceases, and the ulcers of the urethra heal at the same time, the cure of a gonorrhœa is perfected; on the other hand, if the inflammation be only removed, and the ulcers remain open, a gleet must ensue.

It is upon this principle of ulcers subsisting in the urethra, that Daran accounts for the action of his bougie, supposing it to have the property of healing them with a sound cicatrix after the urethra is opened. And, if in the operation it can be understood when there are ulcers, it will not be difficult to comprehend it when there are none; since it seems to have the power of opening every unbound cicatrix of the urethra, and bringing them immediately into an ulcerated state.

There are many who imagine that the prodigious in-

crease of certain gleets at particular times, lasting only for two or three days, and then suddenly abating to their wonted quantity, is inconsistent with a purulent discharge; and therefore conclude a gleet to be nothing but a preternatural excretion from the relaxed vessels of the urethra. But it is probable, that, however the matter of a thick gleet may be furnished by secretion, still the stimulus provoking the secretion is kept up by the subsistence of ulcers; and also that, when the gleet is very thin and in small quantities, it is the mere discharge of those ulcers. A temporary increase of a gleet is not wonderful, because habitual ulcers of every other part of the body are often in a fluctuating state, and generally suffer from excesses of every kind.

Astruc, in this disorder, recommends milk, either of asses, goats, or cows, to be drank morning and evening for some time; then mineral waters, whether chalybeate or vitriolic, for 15 or 20 days; and afterwards balsamics, to deterge and cicatrize the ulcers concealed in the urethra, such as balsam of capivi, from 6 to 12 drops, made into a bolus with powder-sugar; last of all, astringents to dry up the ulcers, and to recover the lost tone of the parts, such as infusions of the leaves of mint, horehound, agrimony, plantain, red roses, shepherd's purse, sage, &c. or the mint-water of Quercetan, so often recommended by Riverius against obstinate gleets.

#### V. *Of CHANCRES.*

ASTRUC observes, that chancres were the *caries pudendorum* of the ancient writers, and are generally seated on those parts which have a fine and tender covering, through which the virulent sanies, issuing from the exulcerated genitals of either sex, has the easier admittance. Such are the inward duplicature of the prepuce, the inside of the pudenda in women, the nipples of nurses, the lips and tongue of prostitutes. In very bad cases they will appear on the dorsum penis, as well as on the pubes and inside of the thighs.

In the cure of the recent chancre, he first orders bleeding, to abate the inflammation; then fomentations, to resolve the induration; not omitting mercurials in the mean time, but so as to avoid a salivation. After which he advises the use of sudorific decoctions of china, sarsaparilla, guaiacum, and saffras boiled with antimony.

Turner formerly used red precipitate sprinkled on a proper ointment.

Of late years, he says, he always found smoking the parts with cinnabar successful in chancrous ulcerations on the glans and præputium of men, as well as the labia and sinus pudoris of women. His method was to throw a dram of cinnabar on a heater or hot iron, letting the fume ascend through a funnel, or a seat perforated like a close-stool, all round the diseased parts. This was done every day, and sometimes twice a day for a week. The iron was hot enough to raise flame with smook, but not so fiery red as to make it instantly consume away in flame alone.

#### VI. *Of the Phimosis, Paraphimosis, and Crystalline.*

THESE are disorders proper to men, except the crystalline; but Astruc affirms, that women have something of the

the same nature; and even extends them to their nipples, where the ulceration constringing the area or circle round about them irritates the same. The phimosis of women is the constriction of the entrance into the vagina.

He begins the cure with bleeding and gentle purgatives, such as *castia cum manna* and *merc. dulc.* instead of brisker cathartics and emetics, which, as Turner thinks, by making a stronger revulsion, afford speedier relief.

He then advises adodyne emollient fomentations and cataplasms to relax and soften, and afterwards discutients to breathe forth the humours; and, if the penis is soaked therein an hour or two twice a-day, the effect will be more certain; but if a stagnation is threatened, and thence a gangrene, the prepuce is to be divided in the phimosis on each side the glans, and the folds of it to be cut through in the paraphimosis; by which the strangled glans may be set free, and the chancre, if any, brought into view. The like must be done for the crystalline, in order to discharge the imprisoned lymph, and forward the subsidence of the prepuce, thereby inflated and puffed up.

The affected parts in women should likewise be fomented with the like emollient and mucilaginous decoctions, of the roots of marsh-mallows, white-lily, water lily, and the leaves of branc ursine, mallows, linseed, &c. several times a day. Afterwards, a pessary made of linen or sponge dipped in the emollient liquor should be introduced into the vagina.

#### VII. Of Tubercles and Scirrhus Cords.

THE tubercle is a callosity remaining after healing the chancres of the glans, which hinders the free play of the foreskin over the glans. If this will not yield to a strong mercurial unction, the only remedy is circumcision.

The scirrhus cords are tubercles which arise where there has been an ulceration; and may be left under the skin of the penis, sometimes round, and sometimes like a cord. They arise gradually, and disappear with the help of a little mercurial unction, and a course of mercurial purging, unless complicated with other symptoms of a worse kind.

#### VIII. Of the Porri, Condylomata, Chirstæ, and the like Excrescences.

THE venereal porri, whose seat is the pudenda, if they are recent, small, and soft, sometimes dry and fall off of themselves, after the poison has been destroyed by mercurial frictions; but if they are hard, large, and have deep roots, they will sometimes continue after them, and grow like warts in other parts of the body. In this case they must be cut with the point of the scissars as near the skin as possible, and a mercurial plaster must be prepared with a large proportion of mercury, and mixed with *diach. cum gunn.* to promote a suppuration, and to dissolve the callosities at the bases of the porri, before a cicatrix is formed.

But if the basis is hard, and surrounded with hard and deep callosities, slight mercurial frictions must be used; and the wound must be dressed with basilicon, sprinkled with red precipitate, to consume the callosities by little and little, to soften the edges of the ulcers and dispose them to heal. If this should fail, stronger corrosives should be used.

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The same directions are applicable to the whole tribe of condylomata, chirstæ, mora, fici, either about the pudenda or anus.

#### Of the LUES VENEREA, or FRENCH POX.

WHEN a gonorrhœa has continued a long while, or long enough for the poisonous matter to make its way into the blood, or, by astringents given unseasonably, it cannot make its exit, then the patient is infected with the pox.

The buboes in the groin constitute the first degree; then follow pains which cruelly torment the head and joints of the shoulders, arms, and ancles, coming on by fits, but at no certain intervals, unless in the night when the patient is warm in his bed, seldom leaving him till towards the morning.

There are also scabs and scurf in various of the body, which are as yellow as a honey-comb, and which distinguish them from all others. Sometimes they have large surfaces, answering the description which authors give of the leprosy. But the more these scabs are dispersed over the body, the less he is tormented.

All these symptoms gradually increase, especially the pain; which becomes so intense, that the patient is unable to lie in bed. Afterwards nodes or exostoses arise in the skull, shin-bones, and bones of the arms, which, being attended with constant pain and inflammation, at length grow carious and putrescent.

Phagedenic ulcers likewise seize various parts of the body; but generally first begin with the throat, and from thence gradually creep by the palate to the cartilage of the nose, which they destroy, and the nose, being destitute of its prop, falls down flat.

The ulcers and pain daily increasing, the patient sinks under the torment; and being not able any longer to struggle with stench, rottenness, and the loss of one member after another, his mangled offensive carcase is hurried into the grave.

Besides the symptoms proper to the pudenda and parts adjacent, which have been already mentioned, the following are observable in a confirmed pox; which however do not appear in all patients, nor at the same time.

I. The skin, especially about the neck and breast, and between the shoulders, is covered with flat spots like freckles, of a rosy, purple, yellow, or livid colour, sometimes distinct, small and round like lentils, sometimes more large and extended.

It is full of itchy pustules, tethers, and ringworms, a serpigo, a herpes miliaris, and exedens. There are chaps in the palms of the hands and soles of the feet, with itching, from whence proceeds a clear serous liquor, and the epidermis peels off in large flakes.

It abounds with hard, callous, round pustules, rising a little on the top, generally dry, but sometimes moist, scaly, branny, and yellow; frequently on the corners of the lips, and the sides of the nostrils, but more especially on the forehead, temples, and behind the ears, where they appear in rows like a string of beads, and gradually creep among the hair.

The hair not only falls off from the head, but all parts of the body where it grows. Then the nails become un-

equal, thick, wrinkled, and rough; afterwards ulcers arise which cause them to fall off.

II. The inside of the mouth, throat, and nose, are also affected; the uvula and tonsils become painful, hot, inflamed, and ulcerated; pustules appear in the roof of the mouth, which degenerate into round, malignant, phagedenic ulcers, which rot the bone as far as the nostrils. The pituitary membrane is likewise liable to pustules, which produce malignant ulcerations that infect the bones of the nose with a caries, particularly the vomer; which being eaten away, the nose falls down; the voice becomes hoarse and low; the gums being covered with aphthæ, ulcerate and rot; the teeth ache, grow rotten, and fall out; and the breath is very offensive.

III. The patient is excruciated with pains in the night-time, when in bed and covered with cloaths: these are either tensive, pricking, pulsative, or rending; fixed or wandering; which sometimes occupy the muscular and membranous parts like the rheumatism, sometimes the tendons and ligaments about the joints resembling the gout; sometimes they are with tumour or inflammation, sometimes without.

IV. The bones are affected in various manners; in the middle exostoses arise, either soft or hard, sometimes with intense pain, sometimes without. The heads of the bones enlarge every way, but unequally, which produces tumours, pains, difficulty of motion, and stiff joints. As the caries increases, they become brittle, and break upon the least effort. Sometimes they are so far dissolved, as to bend like soft wax.

V. When the lymph is infected, the lymphatic or conglobate glands become hard and callous, and form, in the neck, armpits, groin, and mesentery, hard, moveable, circumscribed tumours, like the king's evil. The lymphatic vessels are dilated, extended, and enlarged by a thick stagnating lymph, and form soft encisted tumours or gummata: In the tendons it causes nodes, in the nerves ganglions, and in the ligaments of the joints topus.

VI. Neither do the ears and eyes escape the fury of this disease: for the latter are externally affected with pain, redness, itching, and lippitude; and internally, being loaded with humours, the sight is destroyed, and sometimes a suppuration supervenes. If the vitreous humour of the eyes is thickened, it causes a glaucoma; if the crystalline, a cataract; if the aqueous, hairs or spiders webs seem to float in the air.

The ears are affected with a ringing noise, hardness of hearing, deafness, and pain, whilst their internal substance is excruciated and rendered carious.

After this catalogue of symptoms, it is no wonder that all the animal, vital, and natural functions should be depraved, the face be pale and livid, the body emaciated and unapt for motion, and that the patient should fall into an atrophy and marasmus.

Women have disorders proper to the sex; as, cancers in the breast, a suppression or overflowing of the menses, the whites, the hysterical passion, an inflammation, abscess, scirrhus, gangrene, ulcer and cancer of the womb. They are either barren or subject to abortion; or the children they bring into the world have an universal erysipelas, are half rotten, and covered with ulcers.

The methods of curing the pox are principally four: 1. The common, by salivation; 2. By giving quicksilver pills; 3. By mercurial frictions, which are to be purged off before a salivation is raised; 4. By sweating, with a decoction of guaiacum.

The safest and most commodious method of salivation is by mercurius dulcis six times sublimed, given inwardly in the milder pox; or by mercurial unctiōn, when the disease is got into the bones.

Fifteen grains of mercurius dulcis may be given in a morning, and the like dose at night, with *electar. e scordio*. After three, four, or five days with this management, we usually observe the fauces to inflame; the insides of the cheeks to be tumid, or high and thick, being ready to fall within the teeth, upon shutting the mouth; the tongue looks white and foul, the gums stand out, the breath stinks; and the whole inside of the mouth appears shining, as if parboiled, and lying in furrows.

The inside of the mouth thus beginning to be wheeled, you may expect soon to see them ulcerated, especially about the salival glands, which empty themselves thereto. Now it may be proper to desist a day or two, to observe the increase of the ulcers, what sloughs are like to be raised, and what their depth and dimensions are like to prove; from which a near conjecture may be made of the duration as well as quantity of the spitting now begun, and the consistence of the drilling lymph whether more or less fluid.

When the salivation is thus begun, your only business is to encourage your patient cheerfully to go on. Let his diet be small chicken-broth, water gruel, and panada. His drink, small sack-whey, or posset-drink, with a draught of good small-beer with a toast between whites.

Thus, after some days respite, if, after the spitting comes on, you find the patient hearty, his chaps but little swelled on the outside, and as little sore within, the ulcers not increasing, with few or no sloughs appearing therein, the flux also inconsiderable in quantity, you may now give a scruple of *merc. dulc.* in *elect. e scord.* at going to rest, repeating it two or three days following, as you find occasion, and then wait the issue again. This is the safest and most prudent method.

If he should have taken half an ounce of calomel, with little alteration as to the swelling and soreness of his mouth, and as little appearance of his slavering, his pulse and other circumstances favouring the same, and no ill symptom appearing, you may vomit him with viij or x grains of turpeth mineral in conserve of roses, or mixed with x or xv grains of calomel, encouraging the operation with small draughts of common posset-drink between whiles, upon each motion to reach, but not loading the stomach therewith, as is customary in other emetics. If there is occasion, it may be repeated two or three days after, which will forward the salivation more effectually than more doses of calomel simply repeated would have done.

If a salivation cannot be raised to any quantity, as in some it cannot, you must forbear and purge it off, and give calomel once or twice a-week, and purge it off the next day, or two days after.

When the spitting goes well forward, it may be left to take its course till it declines of itself; which, in proportion

portion to the ulcers and thickness of the sloughs about the parts of the mouth, may happen at the end of twenty-one days, or a month from its rising; that is, from the time of spitting a pint and a half a-day, till it comes to three pints, or even five pints, in twenty-four hours, when it gradually goes off again. For often the first four or five days, or a week, are spent in bringing it to the first proportion.

In the more stubborn and rebellious pox, attended not only with cruel night pains, gummata, tophs, nodes, and also rotten or foul bones, if the patient has been used to mercurials, or if salivated before, then the cure must be attempted with salivation by unction.

You may mix an ounce of quicksilver with three ounces of axungia; of which, an eighth part is to be used night and morning, letting the patient rub it in with his own hands gently by the fire, beginning with his ankles up to his thighs and knees, all round his joints, and so to his thighs, which are presently after to be covered with yarn-stockings and flannel-drawers; then let him use what remains of his eighth part about his elbows and shoulders, wiping his hands clean about the glands of his arm-pits, or those of his groin. His body, during the unctions, should be screened from the cold with a blanket hung behind him, and then be wrapped up in a warm flannel; that is, he must have a flannel shirt, waistcoat and drawers, a cap, a muffler pinning it up thereto behind, and covering all his throat, chin, and cheeks before, to defend them from the cold air. The same things are requisite in the former way. The weak need only be appointed once a day.

If, when the ointment is divided into four parts, after the third unction the patient begins to complain of his chaps, you must stay a day or two before you proceed farther: The same when gripes or bloody stools approach.

Where there are a gummata, tophs, and nodes, the ointment must be chafed particularly into those parts, and then apply the mercurial plaster upon them. If the spitting declines too suddenly, give a scruple of calomel every day, or every other day, for two or three times, as you shall see occasion.

When he is a little recovered, and his chaps pretty well, he may eat a little chicken, veal, rabbit, or mutton, well roasted, without sauce or gravy.

The patient should be prepared for a salivation by a lenitive purge or two; and, if plethoric, he should bleed: Likewise bathing in warm water, for some hot, lean, emaciated people, has been found serviceable. Women should be laid down just after their menstrual flux is over. Temperate weather is the most suitable.

If the patient is troubled with sickness and vomiting; if mild, give him freely of a small chicken-broth, posset-drink, or thin water-gruel, refreshing him with a little mulled wine between whiles. But if there is a cardialgia, and intolerable pains at the mouth of the stomach, with incessant vomiting, spasms of the members, fainting, cold sweats of the forehead and eyebrows, the patient is in the utmost danger, and you must cease giving mercury, and if possible turn it downwards, by directing the common clyster with 2 or 3 ounces of brown sugar, and as much oil-olive.

To prevent the jaws from being locked up, it is necessary to use a bit of stick covered with a soft rag, which must be held between his backward teeth: But, if there should happen an adhesion of the inside of the cheek to the gum, hindering the patient from eating and opening his mouth, the same is to be carefully divided.

If, during the salivation, a blood-vessel bursts open, make a little pellet of lint, and cover it with the fine powders of alum or virriol, or dip it in the tinctura styptica, and thrust it close down into the cavity, which will secure the effusion, being held tight with the finger for a little while. If it happens from the separation of the sloughs from the side of the cheeks, a little oxycrate held in the mouth will do the business, or an astrigent decoction of oak-bark.

If the patient has been without a stool for some days, give an emollient clyster of warm milk, sugar, and oil. At this time he may drink freely of small beer with a toast, barley water, small sack-whey, or posset-drink. For diet, water-gruel, oatmeal-caudle, small chicken or veal broth, a roasted pippin, or a few stewed prunes.

If, notwithstanding your care in giving small doses of mercury, the fauces should suddenly inflame and tumefy, endangering a suffocation of the patient, the most certain relief is to bring the humours downward by sharp clysters, and, if he can swallow it, a cathartic by the mouth.

An ozæna, or ulcer of the nostril, is best cured by a cinnabarine fumigation, which subdues the malignity, dries up the ulceration, and disposes the caries, if any, to a separation beyond all others, after which, and sometimes before, calomel must be given and purged off; or, if there are other symptoms of a profound infection, you must salivate by unction.

The like method must be used for ulcers of the palate, uvula, and tonsils. The fume rarely fails to stop the farther erosion, and therefore it is always to be directed, though a salivation is intended. It cures, in two or three days time, the most putrid and corrosive venereal ulcers, or after the second or third smoking.

Astruc disapproves of any other method of salivation but by frictions; and he would have pure mercury ground in a mortar, with just so much turpentine as will reduce it into a brown or black powder, and mix with it equal parts of fresh lard, and so well mixt, that the particles of the mercury shall not be visible by a magnifying glass. He also allows that occasionally there may be double the quantity of lard.

He distinguishes the frictions into weak and strong; for the strong he allows not less than two drams of the ointment, nor more than four. The first time, the patient is to be anointed from the feet to the calves of the legs; two days after, from thence to the middle of the thigh; then the third time, as far as the buttocks. If after the seventh day there appears no sign of a salivation, you must proceed to the fourth friction, from the buttocks along the loins and back to the neck, with a large quantity of ointment. If on the ninth day nothing appears, another friction must be from the wrists to the shoulders.

During the salivation, he allows the patient, if he has strength, to get up sometimes, and sit by the fire; or, if he cannot, to sit up in bed: when he lies down, he would have

have him lie in as prone a posture as he can, that the saliva may be evacuated more easily, and not fall into his stomach.

In the weak or slight friction he allows from one to two ounces of the ointment. The first friction is to be only on the feet; the second on the legs; the third on the knees; the fourth on the thighs; the fifth on the buttocks and perinæum; the sixth on the loins; the seventh on the back and between the shoulders; the eighth and ninth, if there is occasion, from the arms to the wrists. There may be three, four, five, or even six or seven days between each friction, if the patient is very weak: But the rule is, to look into the patient's mouth before a new friction, that you may be certain not to bring on too plentiful a salivation. The dose of the ointment must be so managed, that, after the fourth or fifth friction, a salivation may come on that is gentle, easy, governable, without a swelling of the head; with only a few apthæ in the mouth, or at most a few superficial ulcers, and the patient not spitting above a pint or two in twenty-four hours: and to this point it must be kept up, with a new friction, if there be occasion. Likewise it may be kept under with clysters and plentiful drinking of the pisan; and, if necessary, with lenitive purges. This treatment may be continued, *pro re nata*, from 30 to 50 days, or longer.

Till the salivation comes on, the patient may be indulged in weak soups, rice, cream, panada's &c. and even milk for breakfast; but after that they must be left off; and he must drink a large quantity of pisan to dilute the blood. He may sit up all day, if his room be warm.

If, after a due repetition of mercurial frictions, a salivation does not appear, it generally happens that a looseness, a flux of urine, copious sweats, or at least a plentiful transpiration, will supply that defect, and serve in its stead. In this case, the patient may think himself exceeding happy and fortunate, that he has obtained a complete cure by a method more certain and convenient than by salivation, and without its incommodities and dangers.

The second method of curing the pox is by a quicksilver pill. This was brought into reputation by Belloste; and though he has kept the composition a secret, yet there is no reason to doubt but it is quicksilver mixed with a certain proportion of a cathartic.

The third method of curing the pox is by mercurial frictions, which De Salt gives as follows:

When the patients have a pox of a long continuance, and the venereal poison is dispersed all over the body, they should be prepared by bathing and drinking whey. But in a recent pox the bath is not necessary, or at least need not be used long, because the blood is sufficiently diluted.

After this, instead of raising a salivation, bring on a flux of the belly; the whole secret of which consists in keeping the body open by clysters of a decoction of fenna and the pulp of cassia, before the frictions are administered; by which the intestinal glands being opened, the mercury will more readily tend that way. When the looseness does not answer the number of the frictions, nor the quantity of the mercury made use of, purge the patient with powder of jalap, and procure copious stools,

which secure the mouth. While the looseness is going on, the friction does the office of a purge; and in proportion as they are repeated, the flux of the belly revives; and when it slackens or stops, have recourse to the clysters and purges of jalap. Pursue this method till the symptoms cease, and till, by the abundance of the evacuations, the venereal poison is entirely drained off.

The last method is sweating with strong decoctions of guaiacum. This we have the first account of from Sir Ulrick Hutton, who pursued it himself. A pound of guaiacum is to be boiled in a gallon of spring-water to one half, and the scum reserved to anoint the sores, and a secondary decoction was to be used for common drink.

But, when salivations and other mercurial courses have failed, the best method of cure is by the root of sarsaparilla; which discovery we owe to Dr Hunter, who put Mr Fordyce, a surgeon in the army, upon making a trial of it; the result of whose experience is as follows.

1. It will commonly relieve venereal head-achs and nocturnal pains in a very short time; and, if persisted in, he believes it will always cure.

2. In emaciated and consumptive habits, from a venereal cause, it is the greatest restorer of the appetite, flesh, colour, strength, and vigour, that he knows.

3. When the throat, nose, palate, or the spongy bones in general, are affected with a slough or caries, it will commonly complete the cure, if persevered in long enough, provided a mercurial course by unction has preceded the use of the sarsaparilla.

4. When the body is covered with dry blotches or moist sores from a venereal cause, it will greatly promote the cure, nay often complete it; but, without the assistance of mercury, there will be danger of a relapse.

5. In simple chancres it will do little service; but, if it is given in cases where the chancres or buboes will not heal or dissolve after the use of the mercurial unction, it will often cure, and do always manifest service.

6. It will often answer, and that speedily, without sweating, confinement, or any strict regimen, at all seasons of the year, when mercurial unctions and long continued courses of strong decoctions of guaiacum, either by itself simply, or compounded with a small proportion of sarsaparilla, have failed.

7. It seems probable, that sarsaparilla root is the only medicine to be depended upon in venereal cases where mercury has failed, or at least has preceded the use of the decoction; for it is not to be trusted alone. When no mercury has been given, it and this decoction may be administered together, and then there will be no room to doubt of success.

8. Mercury alone will cure most venereal complaints, and sarsaparilla will perhaps always cure them when they resist the power of mercury; and therefore a proper combination of mercury and sarsaparilla will probably cure every case that is truly venereal.

The method of using it is this; to three ounces of the sarsaparilla root, which has not been spoiled with age, worms, sea-water, or moisture, add three quarts of river-water, and make it boil as speedily as possible, in an open vessel, till two pints of the strained liquor remain, that is, about two pounds avoirdupoise weight; a little liquorice-

liquorice-root added to it will make it more palatable. This quantity is enough for twenty-four hours, and may be given at two or three doses either warm or cold. It must be made fresh every other day, and what is not used on the day it is boiled must be kept in a cold cellar. The patient should live abstemiously while he takes it, particularly with regard to wine.

There is another compendious and efficacious method of curing the lues venerea, which has formerly been attempted by the same medicine, but in a different manner, and not with the same success.

Dr. Pringle recommended a method of curing the lues venerea, which at first was brought into a regular practice by baron Van Swieten. His method consisted in giving corrosive sublimate in French brandy or molasses spirits. The proportion was a grain of the mercury to two ounces of the spirits; and his common dose was from half an ounce to an ounce, or, which is the same thing, from one spoonful to two, twice a-day; adjusting the quantity to the strength of the patient and to the virulence of the disease. The operation was either by sweat or urine, especially when the medicine proved most successful. It was continued as long as any of the symptoms remained, with a low, spare diet, plenty of barley-water, and a little milk, or some such diluting liquor.

#### *Of the Yaws.*

THE Yaws is a distemper endemic to Guinea and the hotter climates in Africa; but has of late spread by infection over many parts of Europe. All are liable to it, but more especially in childhood or youth.

It makes its first appearance in little spots on the cuticle, not bigger than a pin's point, which increase daily, and become protuberant like pimples. Soon after, the cuticle frets off; and then, instead of pus or ichor, there appear white sloughs or fordes, under which is a small red fungus. These increase gradually, some to the size of a small wood-strawberry, others to that of a raspberry, others again exceed the largest mulberry, which in shape they very much resemble. In the mean time, the black hair in the yaws turn to a transparent white.

It is not an easy matter to determine the exact time which the yaws take in going through their different stadia. Lusty well-fed negroes have had several yaws as big as a mulberry in a month's time; whereas the low in flesh, with a scanty allowance, have passed three months, without their growing to the size of a strawberry.

The yaws appear in all parts of the body, but they are most plentiful and of the largest size about the groin, privy-parts, anus, arm-pits, and face. They are largest when fewest in number, and *vice versa*. They are not painful unless handled roughly, nor cause a loss of appetite. They continue long without any sensible alteration; and whether they would not in time, when the peccant matter is exhausted through the skin, vanish of themselves; or turn to corrosive ulcers, and affect the bones with nodes, exostoses, and caries; or, by enlarging the excretory ducts of the miliary glands, cause a fluid to transude more viscid than sweat, which by drying on the skin would render the patient scorbutic, scabby, or leprous; is hard to say. It is an infectious disease.

The yaws are not dangerous, if the cure is skilfully managed at a proper time; but if the patient has been once salivated, or has taken any quantity of mercury, and his skin once cleared thereby, the cure will be very difficult, if not impracticable.

The negroes who have been cured in Africa never have them again in America.

As soon as the yaws begin to appear on a negroe, he must be removed to a house by himself; or, if it is not certain whether the eruption is the yaws or not, shut him up seven days, and look on him again, as the Jews were commanded to do with their lepers, and in that time you may be commonly certain.

As soon as you are convinced that it is the yaws,

Take a scruple of flowers of sulphur; five grains of camphorated spirit of wine; a dram of Andromachus's treacle; and a sufficient quantity of syrup of saffron. Make them into a bolus, to be taken at bed-time.

Repeat this bolus every night for a fortnight or three weeks, or till the yaws come to the height; that is, when they neither increase in size or number: Then throw your patient into a gentle salivation with calomel given in small doses, without farther preparation; five grains repeated once, twice, or thrice a-day, is sufficient, as the patient can bear it. If he spits a quart in twenty-four hours, it is enough. Generally, when the salivation is at this height, all the yaws are covered with a dry scaly crust, or scab; which, if numerous, look terribly. These fall off daily in small white scales, and in ten or twelve days leave the skin smooth and clean. Then the calomel may be omitted, and the salivation permitted to go off of itself. A dram of corrosive sublimate dissolved in an ounce of rum or brandy, and the solution daubed on the yaws, will clear the skin in two days time. After the salivation, sweat the patient twice or thrice.

He may likewise drink the decoction of guaiacum and sassafras fermented with molasses, for his constant drink.

Sometimes there remains one large yaw, high and knobbed, red and moist; this is called the master-yaw. This must be consumed an eighth or a tenth part of an inch below the skin, with equal parts of corrosive mercury and burnt alum, and digested with an ounce of yellow bassicon and a dram of corrosive mercury, and cicatrized with lint pressed out of spirits of wine, and with the vitriol stone.

To children under six or seven years old, at the proper time of salivating, [when the yaws are come to their full growth.] give a grain or two of calomel in white sugar, once a-day, one in two days, or once in three days, so as only to keep their mouths a little sore till the yaws dry, and, falling off in white scales, leave the skin clean. This succeeds always, but requires a longer time than in adults.

The venereal disease and the yaws seem to be very distinct distempers; but the symptoms, in consequence of the yaws ill cured, coincide so exactly with the symptoms of an inveterate French pox, that in most cases it will be very difficult if not impossible to distinguish them.

#### *Of the SCROPHULA, or King's Evil.*

THE King's evil is attended with hard, scirrhus, and often

often indolent tumours, which arise by degrees in the glands of the neck, under the chin, armpits, groin, hams, arms, and wrists; but it is most commonly seated in the neck, and beneath the ears.

Likewise cold tumours, which appear on the joints and bones, as on the knees, elbows, hands, and feet, but more particularly on the fingers, are disorders of the scrophulous kind: as also the greatest part of those obstinate fluxions, which fall gradually on the joints, without a manifest cause; and which are attended with an abscess, a caries, and swelling of the bones, called the *spina ventosa*; especially of the apophyses and epiphyses. Of the same-kind are likewise the oedemata or white swellings which arise in the arms, legs, and feet, principally about the joints. They consist of a jelly or coagulated lymph, which puffs them up, but do not pit when pressed with the fingers like dropical swellings.

In the eyes the scrophula creates inflammations; in the eye-lids a puffing up of their edges with great foreness and small ulcers; in the angles of the eye a fistula lachrymalis, by ulcerating the gland planted there for the percolation of tears; in the lips, excessive and preternatural thickness; in the nose it often creates the crusty ulcer called ozæna. All which, except the last, are often the forerunners of this disease, antecedent to the great swellings and foul ulcers which appear in its maturer state.

The glands of the external parts are not alone attacked with this disease; for those of the mesentery are almost always affected; which appears from the opening of persons dying of this disease. Sometimes the disease begins in the mesentery; and sometimes the liver, spleen, womb, lungs, windpipe, brain, and other internal parts, are scrophulous: Hence scirrhus tumours, incurable cancers, obstinate fluxions, rebellious ophthalmics, malignant abscesses, fistulous ulcers, dangerous quinseys, terrible epilepsies, mortal consumptions of the lungs, stubborn jaundices, dropics, cholics, hypochondriac and hysterick affections.

The scrophulæ are hard tumours, because they are produced by a thick coagulated matter; they are cold, because they are caused by a stagnation of the lymph in the part affected.

The scrophulæ may be said to be benign, when they are superficial; when they do not much raise the skin, nor change its colour; when only the glands are puffed up, and are soft, moveable, without adhesion and indolent.

The malignant scrophulæ are evident from the largeness of the tumour, its hardness and adhesion; from its becoming livid or red; from its being painful; and, when ulcerated, from the callosity of the lips of the ulcer, and from their difficult cure.

As to the prognostics; the benign scrophulæ admit of an easy cure, especially if they are seated in the conglobate glands, and are moveable, superficial, and soft. Those which attack the joints, the tendons, the ligaments, the bones, which are near large vessels, or compress the aspera arteria, or the oesophagus, are very difficult to cure. The internal scrophulæ are much more dangerous than the external; for when they turn to an abscess, they are incurable. They are also more or less troublesome in proportion to the progress they have made, the parts which they attack, and the temperament of the patient. If the strumæ have been long ulcerated, and are become sinous and vi-

ruent, and if they lie near one another, they often find a communication, though they appear distinct: In this case the lips grow callous, and the ulcers corrosive, frequently fordid; and the cure is not to be expected as long as one cystis remains of the vessels that feed them. Those who are seized with strumæ in the neck after forty years of age, seldom recover.

If strumous tumours arise from a caries in the bones of the fingers or hands, the cure is difficult; but more so in the feet and toes. If in the os calcis, joint of the ankle, or astragalus, or in the knee-bones, or ichia, or the like, where they cannot be safely laid open, the case is deplorable, and the patient generally dies of a marasmus.

In the cure, the diet should be thin and attenuating, light and easy of digestion; and all salt and smoke-dried meat should be carefully avoided; as also beef, pork, fish, hare, cheefe, and in general all things that are hard of digestion, or which yield indifferent nourishment. The air should be pure, sweet, and dry; and the body should be kept always open.

The cure may be begun by bleeding, especially if the patient is plethoric, and then a mercurial or antimonial vomit; after which he should take a gentle purge, often repeated, such as the common purging potion of Sydenham; and, as almost all remedies which are good in venereal cases are useful in this, mercurial vomits and purgatives will be proper.

Some give ethiops mineral alone for three months; beginning with twelve grains, and increasing the dose gradually to a scruple, or half a dram, and decreasing in the same manner.

It is certain that the united force of mercurials and antimonials will do wonders in these cases, if prudently given and long continued; always beginning with small doses at first.

Some make use of the decoction of sponge; the dose is four ounces: others, burnt or calcined sponge; the dose is half a dram morning and evening. Turner mentions a cure from an electuary made of the most gritty and fabulous sponges that could be got, which were dried in an oven so much as to be fit to pulverize. The dose was a spoonful night and morning.

Others recommend the absorbent powders and diaphoretic antimony; others again, tincture of antimony in a glass of the decoction of the woods; Dr Francis Fuller, the decoction of colts-foot used for a long time. Fallopius praises the root of butchers-broom; the dose is a dram with x. gr. of the root of common flower-de-luce. *Ann. de Villanova* looks on the root of scrophularia or figwort as a specific; the dose is a scruple in powder. And Allen mentions two cures performed by white archangle, boiled in milk, which it coagulates; the whey of which must be drank, and the curd applied to the sores. Of late the mineral waters of Moffat in Annandale have been drank with great advantage.

Epsom salt dissolved in a pint of water in such a quantity as to keep the body open, and taken like sea water, has often cured this disease.

After all, we have another medicine whose virtues in curing this disease have been lately celebrated, *viz.* the Jesuits bark.

1. Take of the best rhubarb, half an ounce; of florentine

rentine orris, an ounce; of dried red roses, a dram and a half. Infuse these, after they have been cut and bruised, in two quarts of small ale; and let the patient drink a glass of the colature twice a-day, with the quantity of a nutmeg of the following electuary:

2. Take of the powder of the Peruvian bark, six drams; of saffrafrs bark in powder, two ounces. Make them into an electuary with a sufficient quantity of the syrup of sugar.

Dr Fothergill has likewise long given the bark in scrophulous disorders, and affirms that it may not only be given with safety, but to manifest advantage in many of these cases.

He gives the bark in a liquid form, in the following manner:

3. Take of Peruvian bark in powder, an ounce; and boil it in a quart of pure water to a pint. Towards the end, add of sliced liquorice-root half an ounce. To the colature add of nutmeg-water two ounces, and mix them. The dose is two, three, or four spoonfuls, with ten, twenty, to forty drops of the volatile tincture of guaiacum, twice or thrice in a day.

A small quantity of winter's bark, added to this medicine, gives it a grateful warmth, and renders a quantity of the compound water less necessary; and a little liquorice, a few raisins, gum arabic, or the like, added to the decoction before it is taken off the fire, by making the liquor viscid, enables it to suspend more of the fine particles of the bark, and at the same time renders it less disagreeable.

The swellings of the joints, commonly called white-swellings, are of the strumous kind, and of two sorts: they are both made by congestion, and increase gradually; the one arises externally upon the tendons, and between them and the skin, or between them and the bone; the other internally, within the bone itself.

That which arises externally affects the ligaments and tendons first; and sometimes relaxes them to such a degree, that the heads of the joints frequently separate one from another, and the member wastes away and grows useless. But most commonly the humours, by overmoistening the ligaments and tendons, produce a weakness and uneasiness in the joints, raising a tumour externally, and, in its progress, the membranes and bones are corroded by the humour. It will be more certain that the tumour is the offspring of the king's evil, if there are strumous symptoms in any other part of the body.

In order to the cure, in the beginning of the fluxion, apply astringent and drying plasters of red lead and bole, with moderate bandage, and place the member in such a position as may prevent the descent of the humours. The internal remedies may be the same as in the general cure. Cheyne and Allen say, water pumped on the tumour is a certain remedy.

#### *Of the CANCER.*

A CANCER is a hard, round, unequal, painful, and generally immovable tumour, of a livid, blackish, or leaden colour, surrounded with swelled, crooked, varicous ves-

sels, in some sort resembling the feet of a crab, from whence this tumour takes its name.

A cancer is either occult or manifest. An occult begins at first with a small and almost indolent tumour, about the size of a pea, or a hazle-nut, which does not change the colour of the skin, and sometimes lies dormant for several years without making any progress.

But as soon as the virulent humour begins to become more active, the small tubercle becomes all of a sudden a large, round, livid tumour, with an unequal superficies. It is generally attended with an intense shooting pain. At length it begins to eat and break through the skin, and so becomes a manifest or ulcerated cancer, from whence proceeds a fordid, viscid, bloody, sanious or ichorous matter, attended with an insupportable stench.

Though a cancer may infect any part of the body, it generally appears in the breasts, armpits, behind the ears, in the lips, nose, and private parts: women are more subject to them than men. Its general seat is the glands, and is a-kin to a scirrhus.

An occult cancer is known to be formed, when, after the signs of a preceding scirrhus, a titillation, itching, heat, redness, are gradually perceived, with a shooting, burning, pricking pain. The colour of the skin likewise changes from a carnation to a deep red; then it becomes purple, blueish, livid, and at length black: The part feels very hard, unequal, and rough; and then it rises with an apex in the middle; the swelling increases, and the adjacent veins become tumid, knotty, varicous, thick, and black.

When it begins to break, the skin is excoriated, and there transudes through it a thin sharp ichor.

After this the sound vessels on the edges of the cancer, being distended by the rising of the tumour, are broken; hence arises a putrefaction, which turns into a subtil, sharp, fetid, cadaverous sanies, which, corroding and eating away the sound parts, makes a progress in depth as well as in circumference, and sends forth malignant roots, by which it takes fast hold; the lips become tumid, parched, and offensive to the sight; the pain is intolerable, with a sense of burning, pricking, and gnawing; the colour becomes cineritious, livid and black. Afterwards arise occult cancers communicating with the glands; hæmorrhages; convulsions; a slow fever; a general wasting; loss of smell; callous tubercles in the ears without pain; fainting fits. The parts being thus eaten away and consumed, death ensues.

In persons of a good habit, an occult cancer may be pretty easily borne; but if it be disturbed, the preceding ravage must be expected.

A small, incipient, free cancer, seated in a suitable place, not joining to large vessels, arising from an external cause, in a juvenile, sound body, and being the only one in the body, should be extirpated without delay.

Outward applications of all kinds, except the plumbous and narcotic, are to be shunned, because they have a tendency to ulcerate an occult cancer.

If the cancer be large, old, adherent, in a place unapt for extirpation, growing to or lying upon large vessels arising

arising from an internal cause; and the patient being old, disposed to these kind of disorders, and having more than one; neither excision nor topics are proper.

For unless it be extirpated, root, branch, and seed, it will be exasperated, and strike inwards, generate others, and increase those already formed.

The cause of a cancer must be taken away with it, or before an attempt of that kind is made.

A cancer of the fauces, palate, armpits, or groin, is incurable; of the lips is hard to cure.

When a cancer is large, &c. as above-mentioned, all we can do is to leave it at rest, and to appease the symptoms.

The first point is obtained by defending it from external injuries, by applications consisting of plumbeous ingredients and narcotics; by diminishing and correcting the cause. For this purpose cathartics with mercurials in a small, and sometimes in a double dose, will be proper; as also diluents, aperients, and subalkalious remedies; taking care not in any manner to increase the cause.

When the cancer is ulcerated, if it cannot be taken off, it should be kept as clean as possible, and be appeased with the most soft saturnine applications.

Mr Gataker has found, that the *solanum hortense*, as well as the lethal, otherwise called *belladonna*, has had surprising effects in the cure of obstinate pains, ulcers without malignity, scorbutic eruptions, and even cancerous ulcers of the face, and scrophulous sores on the thighs. Junker affirms *belladonna* has cured a most deplorable cancer of the breast. The dose of either is a grain or two at night going to bed, which sometimes makes the patient giddy at first. Three will often vomit, sweat, or purge the patient moderately. Boiling water must be poured upon the herb, which must be afterwards squeezed out.

#### *Of the ELEPHANTIASIS, or Leprosy of the Arabians.*

THE leprosy is said to be of two kinds; that of the Greeks, and that of the Arabians. The latter is called *elephantiasis*, from the roughness, inequalities, and tubercles in the skin, resembling that of an elephant. Lucretius supposed it to be generated in Egypt, and no where else; but if the leprosy of the Jews is the same as that of the negroes, which is highly probable, then we may affirm that it is endemic to the southern and inland parts of Africa.

That it was contagious, all histories agree, as well as farced as profane; and the Persians would not let a leprous person come within the city-walls.

Pliny informs us, that the first appearance of the *elephantiasis* is in the face, particularly a small speck appears on the nose or nostril; and, as the disease increases, the whole body is full of spots of various colours; the skin is thick in one place, and thin in another, hard and rough, with scabs. In process of time, the skin turns black, and the disease eats away the flesh to the very bones. Celsus observes, that the spots grow tumid and red, and then turn black, and the skin is covered, as it were, with scales. Then the body falls away, the mouth, legs, and feet swell, and the fingers and toes are hid with a swelling; even the bones themselves do not escape; afterwards a fever arises, to which the patient falls an easy victim.

But to set this matter in a still clearer light, it will be

necessary to add the description of this disease from *Guido de Chaulias*. The leprosy, says he, commonly begins in the face and forehead, in which filthy tubercles make their appearance, and by degrees spread all over the body. The eyebrows swell; the nostrils grow wider outwardly, and straiter inwardly; the lips are disfigured with an unsightly tumour; the voice is hoarse and snuffing; the ears are turned back; the forehead is protuberant; the face is of a purple colour; the veins under the tongue are varicous and black; the muscles between the fore-finger and the thumb are eaten away; the hair falls off from the head and eyebrows; afterwards the skin of the whole body becomes black and full of spots, rough and unequal, with crusty scabs full of knobs and fissures, of horrible aspect, which makes it appear like the skin of an elephant. After this, the fingers and toes begin to swell; and then the legs, which, being covered with rugged inequalities, seem like two sacks for magnitude. Besides all this, the patient is insatiable with regard to venereal pleasures. The blood is fetid, spotted and black, and will not coagulate.

This disease is hereditary and infectious: for it may be caught by the saliva of a leper, if a sound person drinks after him; by touch; by lying in the same bed; and by coition.

An inveterate leprosy was judged to be absolutely incurable. But Aretæus says, when the disease is new and recent, there are hopes of a cure. What he and Celsus prescribe in order to the cure, are not worth repeating; for, if any medicines will do, they must be of the Herculean kind. Authors are excessive in the praise of viper's flesh, which Hoffman judges to be quite insignificant. Joel advises bleeding and purging, with xij grains of the extract of black hellebore, or iij gr. of the glass of antimony in conserve of roses; but the vitrum ceratum is more safe, and may be given in a larger dose. Towne confesses, that antimonial preparations yielded most relief in Barbadoes; but he could not say that they perfected the cure. On the other hand, mercury exasperated the distemper, irritated the ulcers, and made them spread the faster.

#### *Of the IMPETIGO, or Leprosy of the Greeks.*

THIS distemper begins with red pimples or pustules breaking out in various parts of the body; sometimes they appear single; sometimes a great number arise together, especially on the arms and legs: as the disease increases, fresh pimples appear, which joining the former make a sort of clusters, all which enlarge their borders and spread in an orbicular form. The superficies of these pustules are rough, whitish, and scaly: when they are scratched, the scales fall off; upon which a thin ichor oozes out, which soon dries and hardens into a scaly crust.

These clusters of pustules are, at first, small and few, that is, three or four in an arm, or leg only, and of the size of a silver penny. But, if the disease is suffered to increase, they become more numerous, and the clusters enlarge their circumference to the bigness of a crown-piece, but not exactly round. Afterwards it gradually increases in such a manner that the whole body is covered with a leprous scurf.

Willis blames all dried and salted meats, especially hog's flesh; and fish, particularly shell-fish, because the poor people in Cornwall, inhabiting near the sea coast, were formerly much subject to leprous diseases, and had many hospitals erected on that account.

In the method of cure, says Hoffman, we should endeavour to discharge out of the body the mass of corrupt, glutinous, and acrid humours, by sufficient bleeding and abstinence, and by purges, as well gentle as drastic; then, by proper aliment and a good regimen, promote the generation of wholesome juices; and, likewise by external, detensive; consolidating, and drying remedies, to free the parts from pains, tumours, itching, and ulcers.

The purges may consist of the root and the resin of jalap, the extract of black hellebore, elaterium mixed with calomel, or ethiops mineral, and gum ammoniac.

Among those things which stimulate the solid parts to an excretory motion, and more powerfully melt down the tenacious humours, the lignum and cortex guaiac. exceed all others, as they will generally alone cure the lues venerea. The most considerable, besides these, are the tartarized and acrid tincture of antimony, sulphur of antimony, cinnabar, and, if a venereal taint is suspected, a decoction of crude antimony. Which medicines, in a convenient dose, in the morning, with purifying decoctions drank in bed, afford very great relief.

But, if these fail, recourse must be had to mercury, which some, after extinction, mix with flowers of sulphur and camphor, and rub it on the joints to promote a salivation: others more properly give mercurius dulcis, with double the quantity of crabs-eyes and calx of antimony, rising gradually from three or four grains to a scruple, in order to salivate; with the usual precautions. The cure may also be performed with alterative and diaphoretic preparations of mercury, such as mercurius solaris and jovialis; of which a few grains may be exhibited every morning in conserve of roses for some weeks, drinking in bed after it a pint of some proper decoction.

But it must be observed, that each of these methods of cure requires an air very temperate, a spare thin diet, and an abstinence from fat, and boiled flesh, and acids.

#### *Of the Itch.*

THE itch is a cutaneous disease, arising from a corruption of a serous lymphatic matter, sometimes attended with mild, sometimes with more obstinate and dangerous symptoms. The itch of the milder sort appears either with moist or dry pustules, at first about the joints, and from thence spreads by degrees over all the body, the head only excepted. In the moist sort, to which children and the sanguineo-phlegmatic are most subject, the pustules are more full of purulent matter, attended with a slight inflammation, which is manifest from the redness which appears round about them till it suppurates. The dry sort chiefly attacks those that are lean, old, or are of a melancholico-choleric constitution: In these, the pustules are much less, and excite a most intolerable itching, especially in the night-time. The most usual places where the eruptions appear very numerous, and the itching is greatest, are between the fingers, on the arms, hams, and thighs.

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This disease is, truly and properly speaking, a disease of the skin; because it often is safely cured by topics alone, if timely applied. It is contagious, and may be caught by drawing on a glove or stocking, wiping on the linen, or lying in sheets after persons infected with this malady. Some think it owing to an impurity in the serum, and some to animalculæ. But however that be, it often affects such who have been long kept in prison, who lead inactive lives, and are used to live in a stultish nasty manner, or who constantly eat fish or flesh dried in the smoak or sun, and use any other unwholesome food or drinks; or who live in a cold, moist, and cloudy air, which, hindering a free perspiration, causes a stagnation of humours in the superficies of the body, which are for that reason liable to corrupt.

The milder sort of itch is no way dangerous, and very easy to cure; but the moist more easy than the dry. While it is recent and superficial, it much sooner yields to remedies, than when it is deep, and has infected the mass of blood; and the case is still worse, if there be any fault in the viscera: it is more difficult in old persons than young; in a leuco-phlegmatic or hydropical disposition, as also in a very dry hectic one, it is hard to cure; and, when it becomes universal, it may bring on the leprosy.

The patient should avoid shell-fish, and all salted and high seasoned meats; as also wine, spiritous liquors, strong beer, and every thing else that may inflame the blood. For this reason a slender diet is best, unless perspiration be obstructed.

If the body is phlethoric, we are to begin by bleeding, and afterwards to pursue it by purging, which cannot safely be omitted.

Instead of repeating purging, it is common to give flowers of sulphur in milk, or treacle, with good success.

Willis and many others have a great opinion of the efficacy of sulphur used both internally and externally; to which Turner assents, except in hectic and consumptive cases. But Shaw thinks it is not to be depended on when outwardly used. Yet it is very certain that poor people find a great deal of benefit who drink it inwardly with milk, and use it outwardly with butter, or hog's-lard.

Turner prefers the salt of tartar to most other remedies, it thoroughly purging and cleansing the blood taken inwardly, and, made into a lixivium with spring water, is an excellent wash outwardly.

When the blood is thought to be foul, it will be proper to use diet-drinks, through the whole course, of the roots of china, sarsaparilla, oxylapathum, scorzonera, chichoreum, glycyrrhiza, polypodium, the barks of safafaras, cinnamomum, the shavings of the woods of safafaras, and the like; which will strengthen the solid parts, and dry up superfluous humidities.

It has been a very common practice to cure the itch by quicksilver girdles; but Turner thinks them too hazardous to be brought into regular practice, and Shaw seems to be of the same opinion.

But after all this, if the disease should prove so stubborn as not to give way to the most powerful of the preceding methods, recourse must be had to salivation as the dernier resort, which will prove effectual when every thing else fails; which, however, is not to be made use of till

the case is so desperate as to render it absolutely necessary.

*Of HÆMORRHAGES in general.*

THE blood, which flows spontaneously, generally proceeds from those places which are of a fine and thin texture, in whose surface the slender vessels creep along with various meanders; such as the inward part of the nostrils, the bronchia of the lungs, the flesh of the gums, the left side of the stomach, the gut ilium, and the extremities of the rectum, as also the external substance of the womb and vagina. When these parts are distended, and the small arteries open, the blood often breaks out with violence.

Sometimes, though but seldom, hæmorrhages happen in other places where the vessels lie deeper; as from the little finger, from the hand and knee, the breasts in the time of menstruation. There are likewise instances of periodical fluxes from the penis in men.

They generally happen to persons whose bodies are of a soft, spongy, tender texture, and whose vessels are turgid with blood and serum. These were formerly said to be of a sanguine constitution, and are subject to hæmorrhages as long as they live. But the choleric, who have larger vessels, whose fibres are more strongly braided, and whose blood circulates with greater rapidity, are liable to a spitting of blood in their youth. The sanguineo-melancholic are subject to the bleeding piles; and women who are sanguineo-phlegmatic, are obnoxious to vomiting blood.

Boys and youths are most subject to bleed at the nose; in young men the blood seeks an exit from the lungs, whence hæmoptoes and consumptions; the middle-aged are more liable to hæmorrhoidal evacuations, and decrepid old men to pissing of blood.

Hæmorrhages are most frequent at the spring and fall; hence sanguineous apoplexies at those seasons, which are nothing else but eruptions of the blood in the middle of the brain. Vomiting and pissing of blood are more frequent in the autumn. In some, these excretions happen periodically.

When hæmorrhages proceed from a fulness of the vessels, they conduce to the preservation of health; but when they are caused by a poisonous acrid matter, as in malignant and spotted fevers, they are exceeding dangerous. Also when they are derived from an infarction, induration, and corruption of the viscera, especially of the liver, spleen, or lungs, they are generally fatal, because they bring on a cachexy, dropsy, the black disease of Hippocrates, and a mortal hectic.

*Of BLEEDING at the NOSE.*

A HÆMORRHAGE at the nose is owing to the more plentiful appulse of blood to the nostrils by a strange motion of the heart, whereby the small arteries in the pituitary coat become turgid, and too much distended, till at length they gape, and the blood rushes out.

A bleeding of the nose may be promoted when persons of sedentary lives that indulge their appetites, and so become plethoric, put their blood into extraordinary agitation by violent passions and exercise, by spirituous liquors,

spices, heating volatile medicines, hot baths, or suddenly chilling their feet.

Likewise the sudden change of air from hot to cold, and cold to hot, by fits, especially at the equinoxes, may cause this bleeding; as also when from cold and moist the air becomes highly elastic, and *vice versa*. Those, moreover, are liable to it who are afflicted with rheumatic, nephritic, arthritic, and ischiadic pains, or who have fevers or spasms. It sometimes happens before the eruptions of the small pox and measles; and to those who have lost a large limb, or who labour under obstructions of the liver and spleen; hence, in an inveterate survy, dropsy, and cachexy, there often happens a fatal hæmorrhage.

It differs much as to the quantity; some lose only a few drops, some several ounces, and some five or six pounds. No hæmorrhage is more apt to return; which it does to some in a few days, to others in a few hours.

To the plethoric it is generally salutary; and there are many instances of a vertigo, a scotomia, dull heavy pains of the head, a phrenzy, and even an epilepsy, being carried off by a bleeding at the nose. On the contrary, from its suppression there have arisen vertigoes, apoplexies, epilepsies, convulsions, noise in the ears, and hardness of hearing, and even a gutta serena.

These hæmorrhages are critical and salutary in a synochus on a femicritical day, that is, between the third and fourth, or on a critical day, *viz.* the seventh: for, as these fevers are generally caused by a plethora, they are carried off that way.

But enormous and long-continued bleedings at the nose, when they arise from spasms of the internal parts, and are preceded with coldness of the extreme parts, and fainting fits, generally terminate in death.

After a revulsion by bleeding, there is nothing equal to nitre to appease the orgasm of the blood, and to relax the spastic stricture. Next to these are vegetable acids; such as the juice of Seville oranges, barberries, the water and juice of wood-sorrel; but more especially the diluted spirit of vitriol, tincture of roses, made with the water of wood-sorrel and the spirit of vitriol, and drank with spring-water. [Five or six spoonfuls of the common tincture of roses may be given at a time, and repeated as occasion requires.]

If the bleeding is very inordinate, it will be proper to use cooling emulsions, gentle or stronger opiates to moderate the spastic strictures, as occasion shall require. Camphor, mixed with nitre and calx of antimony, will be highly necessary, if the matter of exanthemata or cutaneous eruptions is the cause of the hæmorrhage, as is often the case.

A revulsion may be made from the head, by bleeding in the lower parts; then by temperate pediluvia, and putting the hands into warm water.

As there is often an acrid bilious matter lodged in the hypochondria, the parent of wind and spasms, the powder of rhubarb will be proper, mixt with a few grains of tartar-vitriolate and nitre; as also emollient and carminative clysters, with a due proportion of oil.

Externally, refrigerants may be mixed with discutients, and applied to the forehead, nose, and neck.

But

But it must be noted, that, when the patient is plethoric, the bleeding must not be stopped hastily, if at all; nor when the menses in women have been suppressed, or the lochia, or the bleeding piles in men accustomed thereto; much less must a stoppage be attempted when the bleeding itself is periodical.

In persons of a bilious constitution, cold water alone, drank freely, has had a good effect.

The cachectic should persist long in the taking of rhubarb, either alone, or mixed with digestive salts, such as tartar-vitriolate. If there is any scorbutic disorder in the viscera, besides rhubarb, the patient should drink plentifully of whey.

If any disease proceeds from the cessation of this customary hæmorrhage, it should be promoted with a pen or a straw thrust into the nose.

Some recommend the weaker spirit of vitriol, and would have eight or ten drops of it be given in every draught of liquor. But perhaps the best method of all in obstinate hæmorrhages is that recommended by Mead in the bloody small-pox; or the Peruvian bark alone will generally be sufficient.

#### *Of the Bleeding and Blind PILES.*

A FLUX of blood from the hæmorrhoidal vessels is called the bleeding piles; when the vessels only swell and discharge no blood, but are exceeding painful, they are termed the blind piles.

All copious fluxes of blood from the anus are not to be reckoned of the morbid kind. For the habit of body, strength, age, and temperament, are to be considered. That which is enormous and excessive to one person, may be moderate and salutary to another. That only is to be esteemed pernicious, which continues too long, and enfeebles the patient; whereby digestion, nutrition, and other functions are hurt, and there is reason to fear the production of dangerous chronical diseases.

An excessive hæmorrhoidal flux is generally preceded by a heavy pressing pain of the back and loins; sometimes a numbness of the legs and thighs; a constriction of the external parts, with a slight shivering, and a subsidence of the vessels therein; a hard contracted pulse; a dryness of the mouth and fauces; the urine diminished in quantity, and most commonly pale; a sense of weight about the anus extending to the perinæum; a weakness of the stomach; a flatulency in the lower belly; a frequent desire to make water and to go to stool, with sometimes an exclusion of white bilious mucus; the old and weak have a *procidencia ani*.

In this case, the blood is generally at first black and very grumous, and sometimes comes away in large clots from the varicous vessels; afterwards it becomes red, and at last serous: sometimes it is pituitous, or like the white of an egg. There are instances of voiding a pint or a quart of blood daily; it often continues long, from twenty to thirty, or even forty days.

This flux entirely proceeds from the hæmorrhoidal vessels. The external or blind piles seldom bleed, but turn to painful varices; which being opened weep a little, but will not yield much blood. But the internal piles, which are the offspring of the splenic branch, and are extended

to the inner substance of the rectum, and as far as the sphincter of the anus, together with the small arteries derived from the lower mesaraic, not only bleed plentifully, but, when the flux is suppressed, create diseases of the liver, spleen, pancreas, mesentery, and intestines.

The persons subject to this disease are those of a loose, spongy texture, of a bulky size, who live high, and lead a sedentary life; or to whom it is hereditary. Sharp purges, aloetics, high-seasoned food, free drinking of sweet wines, neglect of customary bleeding, anger, sadness, hard riding, and the like, will usher in this disorder.

This hæmorrhage is dangerous, because it decays the strength, wastes the body, and produces a sense of weight in the thighs. The sleep is laborious, and the præcordia oppressed; there is a rumbling in the belly, and a weak pulse. When it continues long, the ancles swell, and the countenance is ghastly; there is a straitness of breathing; and last of all it terminates in a cachexy, dropy, or a slow and hectic fever.

If the patient is plethoric, bleed; and let his drink be cold water of the chalybeate kind, or whey turned with orange-juice; or juleps made with tincture of roses, cooling waters, and syrup of roses; likewise nitre in powder, with absorbents and strengtheners; and, to appease the spasms, opiates of the mildest kind.

If it continues long, and the flux begins to be serous, then give rhubarb with curants or tamarinds, or, which is much the same, with cream of tartar. Then gentle diaphoretics may be compounded of burnt hartshorn, calx of antimony, wine-vinegar mixed with crab's-eyes, water of elder-flowers, simple alexiterial water, and dia-scordium; or hot decoctions of yarrow, veronica, &c. may be taken in bed, in order to sweat; also half a grain of camphor, mixed with nitrous and bezoardic powders.

In the BLIND PILES there is a most intense pain, especially at the time of going to stool, and the excrements are tinged with blood. Sometimes tumours like warts lie hid in the sphincter, or appear in the verge of the anus.

Sometimes the veins, in the blind piles, are so much dilated with blood as to be very painful and raise tubercles as large as peas, grapes, or eggs: They appear livid, and black, from the stagnation of a thick blood, and, when pressed with the fingers, feel like a bladder filled with liquor. Some are soft and indolent; others hard, inflamed, and painful; render the patient unable to walk, stand, or sit; and produce such a spasm in the anus as not to admit a clyster. Sometimes they bleed, or turn to troublesome itching ulcers, and occasion an abscess or a fistula.

Linen dipped in warm spirits of wine, and emollients, are often of infinite service; and, when they fail, leeches may be applied to exhaust the blood: If they are not at hand, and the parts are inflamed, the lancet must be used; then dressings must be made with lint, with compresses and the T bandage. The tubercles, which are full and large, may be removed by a ligature, unless inflamed. Sometimes they are high in the rectum; and then a speculum ani must be used; in which case they must be either scarified with a lancet, or divided with scissars, that the thick noxious blood may be discharged, and the pains relieved.

*Of the Immoderate Flux of the Menses.*

THE symptoms which attend this disorder, are loss of strength, anxiety of the præcordia, fainting, coldness of the extreme parts, paleness, convulsions, suffocations; and, when it is inveterate, oedematous swellings of the feet, a cachexy, dropfy, the fluor albus, a hectic fever, and an atrophy.

Sometimes the flux returns twice in a month; and at others continues several days longer than usual. It comes sometimes before and sometimes after abortion. Sometimes florid blood rushes out with impetuosity, most frequently before a miscarriage, and after it from a retention of part of the after birth, which keeps the orifices of the vessels open. Sometimes clots of blood come away of the size of an egg, when the menses have been stopped for two or three months. A black, grumous, coagulated blood will now and then come away on the first days of child bed, when the patient is slender and plethoric. In the cachectic, the flux will be often thin and watery; in the scorbutic corrupt and fetid, attended with sharpness and pain.

It is sometimes caused by a great afflux of blood to the uterus, which is not returned in due quantity by the veins; for which reason the vessels often burst. The same happens from a plethora, and from hard labour. About the fiftieth year, when the menses cease spontaneously, a great and sometimes dangerous flux will happen, and then quite disappears. If it should suddenly and unexpectedly return about sixty, with flooding, it brings on a fatal hectic fever.

This disease is generally preceded and accompanied with a tension and inflation of the hypochondria; a heavy, pressing pain about the loins, with a chilnens; as also a coldness of the extreme parts, a subsidence of the vessels, a paleness, a quick pulse, an inward heat, a costiveness, and little urine.

If a child-bed woman is not sufficiently cleansed at her lying-in, a great hæmorrhage will follow some months after, with fainting fits, and will not terminate till the excretion of a carnosous mass as big as one's fist, which the sex call a mole.

If the body is cacochymic, and full of depraved juices; scorbutic, or infected with the venereal lues; when the viscera are unfound, and the liver, spleen, and meseraic vessels are stuffed with a black, thick blood; this disease is not without danger. The patient's life is greatly in danger when the child is dead before delivery, and a great flux of blood happens. It is dangerous when caused by a violent extraction of the after-birth; or when pieces of it are left behind, which afterwards become moles, and greatly vitiate and increase the menstrual flux.

If the patient is plethoric, bleed in the arm. If there is an orgasm in the blood, diluents, humectants, and refrigerants, will be most efficacious: in this case spring-water may be drank alone, or with a little nitre, or with spirit of vitriol and syrup of poppies; the spasms require gentle opiates. To carry off the impure serum, two ounces at least of manna must be given, with a dram of cream of

tartar in an aqueous vehicle. If the flux is obstinate, recourse must be had to astringents.

Thomson of Montrose recommends an improvement of Helvetius's styptic powder; which consists of two parts of crude alum, and one of dragon's blood; whereas Thomson's is equal parts of each; and the alum is to be burnt in a crucible, and the dragon's blood added to it, and afterwards powdered. Mead has three parts of burnt alum to one of dragon's blood.

He says he never found this medicine fail in uterine hæmorrhages, whether to correct the too frequent return of the menses, or their too great abundance, or to stop the flooding of women with child, or to moderate the flux of the lochia.

The quantities which he gives are more or less, according to the exigencies of the patient. In violent bleedings, half a dram every hour; and three drams or half an ounce seldom or never fail to stop the flux.

*Of a Hæmorrhage from the Urinary passages.*

THIS disorder is commonly called pissing of blood; and is an emission of blood with or without urine, from the vessels of the kidneys or bladder, which may be either enlarged, broken, or eroded. It is more or less dangerous, according to the different circumstances which attend it.

If pure blood is voided suddenly without interruption and without pain, we may conclude it proceeds from the kidneys. It likewise comes from the kidneys, if the urine is coffee-coloured or more florid, and generally precedes a fit of the gravel, but sometimes accompanies the passage of a stone through the ureters. But if the blood is small in quantity, and of a dark colour, with or without purulent matter, chiefly if it is emitted with heat and pain in the pubes, it certainly proceeds from the bladder. This is sometimes attended with fainting, difficult breathing, a low, small, and frequent pulse, a nausea, anxiety, and cold sweats.

When it proceeds from the ureters, which are hurt by a large, rough stone, and a small quantity of blood is mixed with the urine, there is a sharp pain in the loins and ilia, and a difficulty of making water, which when made has a fabulous sediment, and other signs of a stone sticking in the ureter. When the coats of the bladder are hurt by a stone, and a little blood follows, it is attended with a most acute pain and a previous stoppage of the urine, together with grumes and fabulous concretions; which also sometimes happens when a stone is firmly fixed in the kidney.

It may be occasioned by a stoppage of the hæmorrhoidal flux; from violent motion of the body, especially riding; from a stone concealed in the kidney: from an erosion and ulcers of the bladder; from external violence; from griping pains caused by violent purges; from sharp diuretics, especially cantharides.

All bloody urine has some degree of danger; but it is most so when mixed with purulent matter.

If the patient is plethoric, or if it proceeds from the suppression of a sanguineous evacuation, bleeding is necessary; as also cooling nitrous draughts, and purified nitre mixed with absorbents, with whey for a vehicle, or barley-water,

water, or small-beer, acidulated with some drops of the spirit of vitriol. The body must be kept open with laxatives, as rhubarb with currants, or with cream of tartar; as also emollient clysters. The relaxed vessels must be agglutinated with decoctions of vulnerary herbs; such as agrimony, ground-ivy, yarrow, golden rod, and the roots of comfrey dulcified with virgin-honey, to which milk may be occasionally added. Almond milk is likewise good, especially if used as a vehicle with bole-armeniatic.

If there is an ulcer in the kidneys or bladder, medicines must be given that sweat the acrimony; such as syrup of marshmallows; also infusions of the vulnerary herbs above mentioned; likewise of the bark of the roots of acacia and cherry tree gum.

When grumous blood plugs up the passage of the ureters into the bladder, or the sphincter of the bladder, and occasions a difficulty or stoppage of urine, warm water drank plentifully, and baths of the fame, are useful; likewise warm water should be injected into the bladder with a syringe, that the sharp humour may be diluted and the grumes dissolved. But, if the urine should be quite stopped with a spasm, then give emulsions of the four cold seeds, with crab's-eyes and calx of antimony; or a powder made of sperma ceti, crab's-eyes, and nitre. Externally, apply a bladder filled with the decoction of emollient flowers in milk to the abdomen; and keep the body open with manna, or an emollient oily clyster.

Milk and whey are likewise excellent in these disorders, if a dram of bole armeniatic is taken in every draught.

*Of the LETHARGY, CARUS, and other sleepy diseases.*

THE lethargy has some affinity to the apoplexy and palsy, and often attends them.

By sleepy diseases are meant a preternatural propensity to sleep, sometimes attended with, and sometimes without a fever: The immediate cause of which is a very languid and diminished influx of the animal spirits from the cortical part of the brain into the medulla oblongata, and from thence into the nerves destined for sense and motion.

There are several kinds of these disorders, the principal of which are a coma vigil, a coma somnolentum, a carus, and a lethargy.

A coma vigil is known by these signs: a burning and extensive pain in the head, attended with a sense of ebullition therein; they have a strong inclination to sleep, and yet either don't sleep at all, or, if they do, awake immediately with little relief, but have no delirium. This coma differs from the pervigilium, which is frequent in acute fevers, for in this there is no propensity to sleep. This disorder is always symptomatic, and often attends acute, burning, and malignant fevers; as also an inflammation of the dura mater, and ushers in a phrensy.

In a coma somnolentum, the patients are languid, and their chief complaint is a constant drowsiness. They often fall asleep at their meals, in conversation, and in the midst of business, and, when they are awaked, soon fall asleep again. This disorder principally seizes old men, who live luxuriously, and neglect bleeding. It is a primary disease, and without a fever.

A carus is a profound sleep, out of which the patient cannot be roused by clamours, shaking, nor even with the

pricking of a needle; or, if they are sensible of the pain, they continue silent, and fall asleep again. It is sometimes a primary disease, and sometimes symptomatic. When it is symptomatic, it is of three kinds: The first happens in acute fevers, in the beginning or increase; and, if the convulsions and hiccups supervene, it is soon fatal. The second comes after acute fevers; and, when the patient is exceeding weak, the sleep will continue for several days; being awaked, he will answer questions, but immediately fall asleep again. When he recovers, he remembers nothing that he said. If it happens in acute fevers, on critical days, with a sweat, it is a good omen. The third happens a day or two before death: for, the patient's strength being exhausted, he lies deprived of sense and motion, as it were in a profound sleep, and under that expires.

A lethargy is a heavy and perpetual sleep, with scarce any intervals of waking. It is attended with a stupidity, and so surmounting a forgetfulness, that, when the patient yawns, he forgets to shut his mouth; or, if he takes the chamber-pot to make water, he forgets to do it, and falls asleep.

A lethargy is attended with a fever, which is a symptom thereof, and is chiefly discovered by the frequency of the pulse; whereas a carus is often a symptom or a consequence of a fever, and is likewise attended with insensibility. It does not invade so suddenly as an apoplexy, which is attended with an abolition of all sense and voluntary motion, and kills sooner than a lethargy.

In the cure of these diseases, three intentions should chiefly be regarded; 1. To rouse the patient from sleep. 2. To remove the difficulty of circulation, and the stagnation or extravasation of the blood or serum in the head. 3. To restore the strength of the membranes and vessels of the brain.

Those remedies are efficacious in the first case, which act on the nervous parts, by inducing a tremulous and oscillatory motion through the whole nervous system: such as powerful acids, mixed with tincture of castor; volatile salts; fetid things, as galbanum, burnt partridges feathers; cold water thrown on the head; cataplasms made with vinegar, rue, bay-leaves, tops of savory, mustard-seed, castor, and camphor, applied to the head, forehead, and temples.

The serous colluvies is derived from the head by stertoratories; the best is ten grains of salt of white vitriol dissolved in half an ounce of marjoram water, and drawn up the nose; blisters on the feet and neck; cupping-glasses, either with or without scarification; strong frictions on the lower parts; stimulating clysters, with the addition of *sal. gem.* common salt, or the root of squills.

To remove the stagnation, and promote the circulation, if the vessels are turgid with blood, venesection is necessary; then gentle laxatives, and nervous medicines with diaphoretics. A powder made of salt of hartshorn, salt of amber, cinnabar of antimony, and bezoar mineral, has very great and salutary effects.

A carus, especially the first species of it, requires plentiful bleeding; and the patient must be roused by clysters, rendered stimulating with the powder of squills; by blisters; by putting distilled vinegar in the nostrils; and

and by appeasing the orgasm of the fluids with cooling fixed diaphoretics and acids. The second species requires but little or no assistance; and the third is incurable, at least if blisters fail.

A coma somnolentum is divided into serous and sanguine. The first requires the natural serous evacuations to be restored or promoted. Gouty fits are to be invited by frictions of the feet, blisters, relaxing applications, and warm baths. Sternutatories are of great use, as they discharge the serum through the nose, and stimulate the nerves. When a viscid phlegm offends the stomach, vomits are useful, with half a scruple or a scruple of powder of squills, or ij gr of emetic tartar, with a laxative potion.

In a sanguine coma somnolentum, when the blood circulates slowly, or stagnates in the head, as in the hypochondriac or scorbutic, all hot spirituous remedies are as bad as poison: But bleeding, clysters, gentle laxatives, cooling and nervous powders, are useful.

A red face, eyes turgid with blood, indicate bleeding. Warm baths are bad in all sleepy disorders; likewise saffron, poppies, and opiates of all kinds.

#### *Of the CATALEPSY.*

The catalepsia is also called catochus, and catoche; and whoever is affected with it is in an instant rendered as immovable as a statue, without sense, and without motion; and continues in the same posture they were in at the moment they were seized.

The proximate cause of this disease is the immobility of the common sensory from the time of the first attack; therefore there is an absolute rest of the blood in the brain, of the glands of the brain, and of all its emissaries; whereby all the functions of the brain are injured, as well as those that depend thereon: The muscles only remain tense as in the beginning; the respiration and pulse indeed continue, but they are very faint.

But Hoffman asserts, that the pulse is natural, and the breathing free and easy; that the limbs are moveable, but remain in the same situation in which you place them. They neither hear nor see, though their eyes are open; nor feel, though they are pricked ever so much; yet, if you thrust any thing into their mouths, they will swallow it: But their bodies are so bound, that you cannot thrust the finest pipe into the anus. The colour of the face continues florid. At last they fetch deep sighs, and come to themselves, and tell wonderful things of what they have seen and heard during the paroxysm; some declare they have enjoyed exquisite pleasures, or seen tragical sights, or have had divine visions, and the conversation of angels.

This disease is generally preceded by obstinate intermitting fevers, especially quartans; by a dry, melancholy, lean temperament of body; by a retension of the menses, and hæmorrhoids; by great and sudden frights; by a profound, constant, fixed meditation on one object, or by strong fevers in persons of a sanguine constitution.

The method of cure is various, according to the different causes. The patient should be excited with things that greatly strike the senses; such as light, noise, stimulating things, volatile salts, pain, frictions, continual agitations; by causing an hæmorrhage of the nose; by promoting the hæmorrhoidal or menstrual flux; by sternuta-

torics and emetics; by blisters; by issues; by setons; by a moistening diet.

#### *Of the VERTIGO.*

A vertigo, giddiness, or swimming in the head, is a disorder in which all visible objects seem to turn round, attended with staggering, or danger of falling.

A giddiness, when it is not an original disorder in the head, is caused by a long turning round of the body; by looking from a high place; in some, by passing over a broad river, by riding in a coach, by sailing in a ship or boat, and by drunkenness.

A higher degree of a vertigo is a scotomia, when the patient is seized with a sudden dimness or temporary deprivation of sight. The highest degree of all is, when he falls down in the fit: This borders nearly on the epilepsy.

But it may be doubted whether a scotomia is always a symptom of a vertigo, properly so called; because it often follows great hæmorrhages, long fasting, and very hard labour.

A vertigo will sometimes arise by consent, from disorders of the stomach; and, as Etmuller observes, often merely from fasting, and then a morsel or two of bread will drive it away.

An inveterate vertigo, beginning without any manifest external cause, foretells in young men an epilepsy, in old men an apoplexy.

The vertigo often arises from a congestion of blood in the head, when the patient is plethoric; or where any usual evacuation of blood is suppressed, or from an omission of bleeding when accustomed thereto. It affects some whose heads are debilitated with hard study, or whose stomachs are loaded with vitiated, especially bilious, humours.

In plethoric cases, laxatives, bleeding in the foot, pediluvia, resolving attemperating powders, cinnabar, nitre with an infusion of tea or betony, are proper. If from a suppression of an usual hæmorrhage, it is to be promoted; but, if this cannot be done, bleeding must be substituted.

Outwardly, camphorated spirit of wine alone, or mixed with spirit of hartshorn, applied to the top of the head and temples, will be useful; or Hungary-water, or volatile salts, or spirit of lavender, may be held to the nose. The same things are good when it proceeds from hard study, with moderate diet and frequent exercise. As also a glass or two of wine at meals, and other strengtheners. But because many learned men have been hurt by the external use of volatile and fragrant spirits as well as apopleptic balsams, these are to be tried with great caution.

If a vertigo proceeds from crudities in the stomach, they should be prepared or dissolved by neutral salts, such as tartar vitriolate; and then they should be evacuated by an emetic; but, if any thing forbids, by a purge. Afterwards give stomachics and cephalics, and advise a moderate use of wine at meals, a sparing aromatic diet, and exercise of the body. Pyrmont water is excellent in this case.

#### *Of the HÛSTERIC PASSION.*

The hysteric passion is a spasmodico-convulsive affection of the nervous system proceeding from the womb, and caused

caused by the retention or corruption of the blood and lymph in its vessels; and more or less infecting the nervous parts of the whole body, by means of the nerves of the os sacrum, the loins, and the whole spinal marrow.

This disease has been very improperly confounded with the hypochondriac passion; for a strangulation of the fauces, an intercepted breathing even to suffocation, a fainting away, a loss of voice, a profound sleep, are the true, proper, and essential signs and symptoms of this uterine disease.

An hysterical fit is generally preceded with a pressing pain in the forehead, temples, or eyes, with an effusion of tears and dimness of sight, a dulness of the mind and senses, and a loathing of all things. When the fit comes on, the patient is exceeding colicive, and yet has a strong stimulus to discharge her urine, which is as clear as water; the breathing is uneasy, difficult, and short; and a languor seizes the whole body. To these succeed a pain in the loins, and a great shivering and shaking; the belly is hard and inflated; afterwards the navel is drawn inwards, and outwardly leaves a great pit; then they feel a sort of a globe arise from the lower part of the belly to the hypochondria and diaphragm. Soon after, the heart begins to flutter and beat, with a hard, unequal, and sometimes intermitting pulse; the extreme parts grow cold; the fauces are straitened, and seem to be bound with a cord; the face is pale, the breathing exceeding difficult, the voice ceases, the pulse is almost imperceptible; and there is such a stricture of the belly, that no flatus can be emitted, nor no clyster given. In some there are convulsions of the head and limbs; others lie in a profound sleep, without sense or motion; others have their face and neck look red and inflamed, with a strong pulse; and others again break out into immoderate laughter, and, regaining their voice, say a great many silly things.

When they begin to come to themselves, the pulse, which was before weak, languid, and obscure, becomes brisk, soft, and strong; heat returns to the extreme parts; the face which was pinched in and pale, begins to expand and look ruddy; the wind forces its way upwards; there is a rumbling in the belly; and at length the patients, waking, as it were, out of a profound sleep, have their voice, senses, and motion restored. Yet they complain of a heavy pain in the head; a languor of the body, feet, and thighs; some have continued in a fit so long that they have been laid out for dead, and have been even buried.

The hysterical passion attacks women that are pregnant, in child-bed; widows that are full of blood, after some grievous passion of the mind; or maids, after a sudden suppression of the menstrual flux. It likewise oftentimes comes on so suddenly, violently, and at unawares, that being deprived of all sense and motion, they immediately fall down.

This disease may be caused by whatever promotes a more plentiful and rapid afflux of blood and the genital fluid to the uterine parts, or impedes the eruption of the menses, or occasions their suppression: hence maids and widows are most subject thereto; also women of a sanguine or bilious constitution who live high, drink generous wines, feed on high seasoned aliment, and are subject to violent passions and commotions of the body and mind. On the other hand, those who live a sedentary life, feed

on coarse, acid, low diet, who have omitted usual bleeding, who are oppressed with sorrows, cares, and disappointments, are liable to this disease; for by these the blood is thickened, the solid parts weakened, and consequently the flowing of the menses rendered more difficult. Likewise sudden terror, and the body being exposed to uncommon cold during the time of the menstrual flux, by giving it a check procure hysterical spasms.

However dreadful and cruel this disease may appear, yet it is not very dangerous in itself, unless ill managed, or the patient be exceeding weak and valetudinary: it is most apt to turn into convulsions and an epilepsy. When it proceeds from abortion, or hard labour, it is very liable to return from any slight irritation of the nervous system. Nor is it very uncommon for the hypochondriac and hysterical disorders to be united, and then the cure is very difficult. This happens to women who lead a sedentary life, indulge extravagant affections of the mind, and are guilty of errors in diet and regimen.

In the cure, it must be carefully observed whether the woman is plethoric, or exhausted of blood and strength. In the former case, the spasms or convulsions are more violent, and copious bleeding is a present help; and many have been brought to themselves who were seemingly dead, if the florid colour of their faces had not shewn the contrary.

In the fit, it will be proper to apply fetid things to the nose, such as *asa-fetida*, preparations of castor, partridges feathers burnt, &c. For women in childbed, a girdle made of Russia leather, and bound pretty tight, is excellent. Likewise clysters made with roots and seeds of lovage, which are specifics, camomile flowers, elder-flowers, veronica, the carminative seeds boiled; to which may be added oil of elder, dill, or camomile.

Externally, plasters made of opoponax, bdellium, galbanum, sagapenum, and *asa-fetida*, may be applied to the navel; or,

Some greatly commend fumigations for the uterus of milk, civet, storax, and benjamin.

Inwardly, the patient may take 30 or 40 drops of tincture of castor in cold water.

Some hysterical disorders observe the lunar phases, and partake of the nature of an epilepsy: They seldom require bleeding, and purging should be used with caution: Emetics are of greater service, especially a little before the fit. In the fit, the best medicines are those which repair the loss of spirits, as Russian castor, gum-ammoniac, salt of amber in pills.

Out of the fit, native cinnabar and wild valerian root are most proper for correcting the juices.

To prevent its degenerating into a chronic disease, particularly the hypochondriac passion, care must be taken to keep the menses regular; which must be done by balsamics, composed of myrrh and-amber, with bitter and carminative extracts, especially zedoary and orange peel, made into an elixir, with a moderately spirituous menstruum. This, frequently taken, helps the digestion, and promotes a regular menstrual discharge.

But it is necessary to observe, that in hysterical cases remedies have a different effect on different women. Some cannot bear fetid medicines, which to others are an im-

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mediate relief. Some have fallen into a terrible syncope, and have come to themselves by sprinkling cold water on the face, when more powerful and spirituous things have failed. Others cannot endure hot things inwardly nor outwardly, as baths, fomentations, liniments, and nervous applications. Anodynes and opiates, which procure ease and rest to some, are very injurious to others who are greatly debilitated, and whose nerves are weak. Some have recovered from a violent paroxysm, by a draught of cold water; which, given to others, has increased the disorder.

Peruvian bark given morning and evening, a scruple at a time, is an excellent remedy in hysteric convulsions.

#### *Of the HYPOCHONDRIAC PASSION.*

THE hypochondriac passion is a spasmodico-flatulent affection of the stomach and intestines, arising from an inversion or perversion of their peristaltic motion, and by a consent of parts, throwing the whole nervous system into irregular motions, and disturbing the whole animal economy.

This disease is attended with such a train of symptoms, that it is a difficult task to enumerate them all; for there is no function or part of the body, that is not soon or late a sufferer by its tyranny. It begins with teasings and windy inflations of the stomach and intestines, especially under the spurious ribs of the left hypochondrium, in which a pretty hard tumour may sometimes be perceived.

With regard to the stomach, there is a nausea, a loathing of food, an uncertain appetite, sometimes quite decayed, and sometimes strong; the aliments are ill digested, breeding acid and viscid crudities; there is a pressing, heavy pain in the stomach, chiefly after meals; a spasmodic constriction of the gullet, a frequent spitting of limpid phlegm, an impediment of swallowing, a violent heart burn, a heat at the stomach, very acid belchings, a reaching to vomit, vomiting, bringing up such acid stuff, that the teeth are not only set on edge thereby, but the very linen or sheets are sometimes corroded.

In the volume of the intestines, especially the small ones about the navel, there are felt heavy excruciating pains, wringings, grippings, with a rumbling murmuring noise; in the gross intestines the pains are more acute. Sometimes there is a looseness, sometimes a most obstinate costiveness, with a retention of the wind; which, when it breaks out either upwards or downwards, is attended with an alleviation of the symptoms, but they soon rage again with as great violence as ever. When there is a frequent urging to go to stool, tubercles generally arise, and the blind piles beset the anus; nay, sometimes a symptomatical flux of blood will burst out. Making water in some is difficult and painful; the urine is thin, limpid, and pale; sometimes it has a copious sediment mixt with fabulous concretions, and often resembles a fit of the gravel.

In the breast there is a great straitness, constriction, excessive difficulty of breathing, sometimes with a sense of fulness, a fluttering and palpitation of the heart.

As the disease increases, the head is molested with an head-ach, hemicranium, various fixed spaltic pains, and what is commonly called the clavus hystericus. A noise

in the ears, with difficulty of hearing; the eyes are clouded with a scotamia; some have double vision, or a pain and dryness of the eyes. In the tongue there is a most troublesome burning pain fixed to a certain space, with a plentiful excretion of spittle, as if the patient was in a salivation.

At length the animal functions are impaired; the mind is disturbed on the most trivial occasions, and is hurried into the most perverse commotions, inquietudes, anxieties, terror, sadness, anger, fear, or diffidence. The patient is prone to entertain wild imaginations and extravagant fancies; the memory grows weak, and the reason fails.

Persons are most liable to this disease from twenty to fifty, and whose solids are soft, lax, and flabby, and their blood-vessels small; as also who are naturally languid, or have been weakened by tedious maladies. Likewise those who lead sedentary lives, and study too hard; inasmuch that this is the peculiar disease of the learned.

The remote causes of these disorders are the suppression of the hæmorrhoids and menses, and other periodical fluxes of blood; an hereditary disposition thereto; a cold and moist constitution of the air; gross, impure, flatulent diet; a sedentary, studious life; sadness, cares, troubles, intense thinking on a single object; tedious diseases not rightly treated; hard labour in child-bearing.

As to the prognostics, if the disease be recent and left to itself, it is rather troublesome than dangerous; but if it be inveterate, and not skilfully treated, or an bad regimen is followed, it is attended with more grievous symptoms, producing obstructions and schirri of the viscera, a cachexy, a dropsy, an hæstic, a convulsive asthma, an incurable melancholy or madness, a fatal polypus, &c. But if it is caused by a suppression of the menses, or bleeding piles, the restoring the flux is the cure of the disease.

As continual fear and diffidence are symptoms of this disease, the patients are always foreboding terrible things, and live in constant dread of death; which render them fickle, impatient, and prone to run from one physician to another. Therefore, when a cure is attempted, they must be admonished to be constant and patient; and then the following indications may be pursued: 1. To correct and evacuate the acid, viscid, bilious filth, and flatulent fordes from the primæ viæ, which yield continual fuel to this disease. 2. The spasms being appeased, to restore the natural order of the peristaltic motion of the intestines, and to recover it from a languid state, that there may be a due concoction of the aliment, and a laudable chyle and other fluids generated. 3. To disperse the stagnated juices; to render the circulation of the blood equable through the abdomen and the rest of the body; and to free the fluids from all acrimony, after facilitating the excretions by urine and through the skin.

4. And lastly, to corroborate the whole nervous system. To answer the first intention, nothing is better in the fit than clysters made with emollient herbs, water gruel strained, camomile-flowers, the tops of yarrow, the oils of sweet-almonds, dill, camomile, linseed, &c. adding a carminative species made of caraway, dill, but more especially cumin seeds. These should be repeated, if the spasms render them ineffectual. If the fæces are harden-

ed, it will be proper to give oil of sweet almonds and water gruel inwardly. Nor must gentle laxatives of manna, rhubarb, and cream of tartar, be neglected, with a few drops of oil of juniper.

If there is a great deal of acid filth in the stomach, crabs-eyes alone will purge.

To correct the fordes in the *primæ viæ*, give the absorbent, precipitating, and antispasmodic powers, such as crab's-eyes, mother of pearl, pulvis marchionis, purified nitre, prepared amber, cinnabar, tartar-vitriolate, with a little castor. It will also be proper to take a decoction of any of the following things in the morning in bed, to promote a diaphoresis, *viz.* balm veronica, betony, agrimony, scordium, carduus benedictus, tops of yarrow, daisy flowers, camomile flowers, fennel seed, &c.

To restore the digestive power of the stomach, give essence of orange-peel, tincture of tartar, dulcified spirit of nitre, &c.

The paroxysms are relieved by tepid pediluvia, made of wheat, bran, water, and camomile flowers. The feet must be put pretty deep therein.

Out of the fit, to discuss the stagnation of the blood, bleeding in the foot will be necessary, especially at the equinoxes, and at other times as occasion shall require; but this should be after laxatives and pediluvia. If there is a disposition to an hæmorrhoidal flux, leeches should be applied every month to the anus; and the patient should also take balsamic pills, with antispasmodic nitrous powders.

To strengthen the nervous system, nothing is better than chalybeates; for they, by a gentle astringent, restore the nerves to their former strength. Outwardly a saponaceous plaster, with camphor, may be laid to the hypochondria with no small advantage.

Nothing is more friendly, nor gives greater energy to the blood and spirits, than riding on horseback almost every day, and for a considerable time together. Nor does riding in a coach want its share of salutary effects.

#### Of MELANCHOLY and MADNESS.

MELANCHOLY and madness may be very properly considered as diseases nearly allied; for we find they have both the same origin: that is, an excessive congestion of blood in the brain: they only differ in degree, and with regard to the time of invasion. Melancholy may be looked upon as the primary disease, of which madness is only the augmentation.

When persons begin to be melancholy, they are sad, dejected, and dull, without any apparent cause; they tremble for fear, are destitute of courage, subject to watching, and fond of solitude; they are fretful, fickle, captious, and inquisitive; sometimes niggardly to an excess, and sometimes foolishly profuse and prodigal. They are generally costive; and when they discharge their excrements, they are often dry, round, and covered with a black, bilious humour. Their urine is little, acrid, and bilious; they are troubled with flatulencies, putrid and fetid eructations. Sometimes they vomit an acrid humour with bile. Their countenances become pale and wan; they are lazy and weak, and yet devour their victuals with greediness.

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Those who are actually mad, are in an excessive rage when provoked to anger. Some wander about; some make a hideous noise; others shun the sight of mankind; others, if permitted, would tear themselves to pieces. Some, in the highest degree of the disorder, see red images before their eyes, and fancy themselves struck with lightning. They are so falacious, that they have no sense of shame in their venereal attempts. When the disease declines, they become stupid, sedate, and mournful, and sensibly affected with their unhappy situation.

The antecedent signs are, a redness and suffusion of the eyes with blood; a tremulous and inconstant vibration of the eye-lids; a change of disposition and behaviour; supercilious looks, a haughty carriage, disdainful expressions, a grinding of the teeth, unaccountable malice to particular persons; also little sleep, a violent head-ach, quickness of hearing, a ringing of the ears; to these may be added incredible strength, insensibility of cold, and, in women, an accumulation of blood in the breasts, in the increase of this disorder.

These things being duly considered, together with the state of the brain in persons who died of this disease, we may conclude, that melancholy is a strong and lively working of the fancy, with a fixed attention of the mind to a particular object, which it continually dwells upon; together with a delirium, a long continual dejection, dread and sadness without any manifest cause, arising from a difficult circulation of blood through the vessels of the brain, where it is too copiously congested and becomes stagnant. Madness is a violent rage attended with rashness and preternatural strength, caused by an impetuous motion of a thick melancholic blood through the vessels of the brain. It differs from a phrenzy, which is a delirium accompanied with a fever, and arises from an inflammatory stagnation of the blood in the brain: for we learn from experience, that all the shining faculties of the mind are changed or depraved, diminished or totally destroyed, when the blood and humours, receding from their natural temperament and due quantity, are not conveyed to the brain in a moderate and equable manner, but on the contrary with an impeded, slow, and languid motion, or with too brisk and violent an impetus.

Both these disorders suppose a weakness of the brain, which may proceed from violent disorders of the mind, especially long continued grief, sadness, dread, uneasiness and terror; as also close study and intense application of mind, as well as long protracted lucubrations. It may also arise from violent love in either sex, especially if attended with despair; from profuse evacuations of the semen; from an hereditary disposition; from narcotic and stupefactive medicines; from previous diseases, especially acute fevers. Violent anger will change melancholy into madness; and excessive cold, especially of the lower parts, will force the blood to the lungs, heart, and brain; whence oppressive anxieties, sighs, and shortness of breathing, tremors and palpitations of the heart; thus vertiges and a sensation of weight in the head, fierceness of the eyes, long watchings, various workings of the fancy intensely fixed upon a single object, are produced by these means. To these may be added a suppression of usual hæmorrhages, and omitting customary

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bleeding:

bleeding: hence melancholy is a symptom very frequently attending hysteric and hypochondriac disorders.

The causes which contribute to the generation of a thick blood, are idleness and inactivity, which weaken the body, impair the functions, diminish the salutary excretions, and render the humours thick, viscid, and stagnant: All which are heightened by solitude, which is apt to give rise to various fantastic and gloomy ideas in the patient's mind.

Likewise acid humours in the stomach will increase the appetite, and tempt them to feed on coarse, gross, stultent aliments, without drinking enough to dilute them sufficiently, whence a matter proper to nourish these diseases will proceed. It is evident from observation, that the blood of maniac patients is black, and hotter than in the natural state; besides, the serum separates more slowly and in less quantity than in healthy persons. The excrements are hard, of a dark-red or greyish colour, and the urine is light and thin.

Diseases of the mind have something in them so different from other disorders, that they sometimes remit for a long time, but return at certain periods, especially about the solstices, the times at which they first appeared. It may likewise be observed, that the raving fits of mad people, which keep the lunar period, are generally accompanied with epileptic symptoms.

This disease, when it is primary or idiopathic, is worse than the symptomatic that accompanies the hysteric or hypochondriac passion, which is easily cured; as is that also which succeeds intermitting fevers, a suppression of the menses, the lochia, the hæmorrhoids, or from narcotics. When the paroxysms are slight in the idiopathic kind, the cure is not very difficult: but if it is inveterate, and has but short remissions, it is almost incurable; which is often owing to this, that they reject physicians and their medicines as poison. It is a bad sign if, after a profound sleep, the patient still continues delirious, and is insensible of cold, or is unaffected with strong drastic medicines. If after want of sleep and long abstinence the patient is exceeding weak, or becomes epileptic, convulsive, or lethargic, death is not far off. Mad people are seldom subject to epidemic or other disorders, and some have lived seventy years and upwards in this unhappy state.

Sometimes this disease terminates by critical excretions of blood from the nose, uterus, or anus. Sometimes diarrhœas and dysenteries will terminate these disorders. Pustules, the itch, and ulcers, have also done the same.

In the cure, bleeding is the most efficacious of all remedies; and where there is a redundance of thick, grumous blood, a vein is first to be opened in the foot, and a few days after in the arm; then in the jugular vein, or in the nostrils with a straw; and, last of all, the frontal vein with a blunt lancet, for fear of hurting the pericranium, a ligature having been first made round the neck to render the veins tumid.

Tepid baths are also convenient, to drive the blood from the head to the inferior parts; and before the patient enters the bath he should have cold water poured on his head, or it should be covered with a cloth dipt therein; for cold water pumped or poured on the head con-

stringes and corroborates the vessels of the brain weakened with stagnant blood, and promotes the more easy discussion of the humours congested therein.

Purgatives are likewise useful; but the lenient are preferable to the drastic: Thus manna, cassia, rhubarb, cream of tartar, tartar-vitriolate, are most convenient when the disease arises from the hypochondriac passion, and a stagnation of the blood in the intestines, and the ramifications of the *vena portæ*; especially when they are taken in decoctions and infusions, not all at once, but at repeated intervals, so as to operate in an alterative manner.

Some kinds of mineral waters are also highly efficacious in melancholy and madness; for since madness generally derives its origin from the melancholy, and melancholy from the hypochondriac passion, and the hypochondriac passion from impure and peccant fluids slowly circulating through the intestines and viscera of the abdomen, the circulation of the blood ought to be rendered free and easy. It is no wonder therefore that mineral waters have been held in high esteem for the cure of these disorders; for these being impregnated with a highly pure alkaline and neutral mineral salt, if they are drank in a due quantity, they not only change the peccant humours, but incide such as are thick, render the glutinous fluid, and open the obstructions of the vessels; they also relax the tense fibres of the solids, and corroborate the weak and tender, as well as, by stimulating the emunctories, they restore all the salutary excretions. The waters of Selters mixed with asses or goats milk have not their equal in these cases. They should be drank in the spring and fall for five or six weeks. The proportion is one part milk to three of water.

But, after all, there is nothing better to remove the cause of these disorders than depurated nitre, but especially in that species of madness which inclines to melancholy; for it corrects the bilious acrimony of the humours; allays the tumultuous motions of the solids, by diminishing the preternatural heat. Sennertus and Riverius affirm, that nitre, given with a little camphor, is a specific in madness.

Particular medicines among vegetables are, balm, betony, vervain, brook-lime, sage, wormwood, flowers of St John's wort, of the lime-tree and camphor: from animals, asses blood dried: among minerals, steel, cinabar, sugar of lead, and the calx and tincture of silver.

Camphor is much praised by the moderns, particularly by Etmuller.

And Dr Friewald affirms, that with a few doses of camphor, of xvj grains each, in pills, he has cured several mad patients, even in inveterate cases.

Stahl recommends a powder of the following cephalic and nervine herbs; vervain, sage, betony, with plantain and white maidenhair.

As to diet, the patient should carefully abstain from salt and smook-dried flesh, whether beef or pork; from shell fish; from fish of a heavy and noxious quality; from aliments prepared with onions and garlick, all which generate a thick blood. In general, he should eat no more than is necessary to support nature. Small-beer or pure cold-water are the best drink. Sweet and strong wines are highly prejudicial; as is also excessive smooking tobacco,

tobacco; for it not only penetrates thick blood, but throws the fluids into preternatural commotions. Change of air and travelling may be beneficial.

Though in deliriums bleeding is highly useful, yet it agrees best with those that are plethoric, bilious, and in the vigour of youth: these likewise will bear frequent purges of corrected hellebore; but then the strength must be repaired by cordial, corroborating, and anodyne sedatives. When the patient is exhausted, bleeding is hurtful, and restoratives good.

As a high degree of the itch has terminated these diseases, it will be proper to make issues in the back, or to procure ulcers with a potential cautery near the spine of the back.

Sedative medicines are good; but not opiates and narcotics, for these induce stupidity and folly. Those that are good in an epilepsy, will be beneficial here; such as castor, shavings of hartshorn, the roots and seeds of piony, and anti-epileptic powders, the valerian root, flowers of the lily of the valley and of the lime tree.

And to the other sort of madness, which proceeds from being exhausted and weakened by autumnal, violent, and obstinate intermitting fevers, and from their being injudiciously treated with bleedings and purgings, it is only to be cured by restoratives, cordials, and corroboratives, long persisted in.

#### Of the HYDROPHOBIA.

THIS disease, as it generally proceeds from the bite of a dog, is called *rabies canina*, or the canine madness; and from its most terrible symptom, the dread of water, *hydrophobia*. It almost always arises from the infection communicated by the bite of a mad animal: yet it has been observed to arise spontaneously in some animals affected with acute diseases.

Almost all kinds of animals may be afflicted with this disorder, and may infect other animals, and even men; as dogs, cats, wolves, foxes, horses, asses, mules, horned cattle, hogs, monkeys, and cocks; but it most frequently attacks the dogs, wolves, and foxes, without any previous contagion.

A hot climate, excessive heats and sudden colds: a long and dry season; feeding upon putrid, stinking, verminous flesh; want of water; worms generated in the kidneys, guts, brain, or nostrils; are the preceding causes of madness in these animals.

When they are going to run mad, they appear dejected, shun company and hide themselves; they will not bark, but seem to mutter or murmur, and are averse to food and water; they will fly upon strangers, but retain some regard for their master; their ears and tails hang down, and they walk along as if they were sleepy. This is the first degree of the disease; and, though the bite is then bad, it is not at the worst. Afterwards they begin to pant, hang out their tongues, froth at the mouth, and gape. Sometimes they seem dull and half asleep; sometimes they will run, but not directly forward, and soon cease to know their masters. Their eyes are dejected, look watery and dusky, their tongues are of a lead colour, they fall away suddenly, and grow raging mad. A bite at this time is incurable; and the nearer they are to

death, with the more dreadful symptoms it is attended.

There is scarce any poison infectious so many ways as this: for it takes effect through the cloaths, without fetching blood; by the breath of the animal drawn into the lungs; by a touch of the froth, if recent; and by applying it to the lips or tongue, when it has been long dried; or by kissing a dog that is mad; or by handling the wound or instrument which was the death of the animal; or by handling things which have been infected by any of the former means.

Again, there is scarce any poison which produces such terrible effects, and causes such a wonderful change in the person infected. When it begins to work, it is most violent and quick; and yet, as it is said, it will sometimes lie dormant for years together before it exerts itself. This diversity depends on the heat of the season, the degree of the disease of the infected animal, and the temperament of the person bit. For the bilious are soonest affected by it; the phlegmatic and hydropic the least; likewise something may be attributed to the way of living, diet, and medicines.

A healthy man, infected with this contagion, finds the effects of it discover themselves in the following order. There is a pain in the place where he was bit, or received the contagion; and then wandering pains in the other parts, chiefly those that are near it; a lassitude, heaviness, listlessness of the whole body; inquiet troubled sleep, and terrible dreams, with convulsions, and subultus of the tendons; continual inquietude; sighs, sadness, love of solitude: This ends the first degree of the disease. Afterwards all the former symptoms increase, with a prodigious strangeness or oppression about the præcordia; a difficult sighing respiration; horror; a shaking and trembling at the sight of any liquid, or bright, pellucid thing; loss of appetite; a possibility of swallowing any thing solid; but, if any liquid is touched with the lips and tongue, it occasions an incredible anxiety, trembling, and terrible convulsions, almost forcing the patient into a rage; then a vomiting of dark, bilious, viscid matter, or porraceous bile; an increased heat, a fever, continual watching; a priapism; a confused series of wild, extravagant thoughts: Here the second degree of the disease may be said to terminate. Now all the symptoms grow worse and worse: the tongue hangs out, and is rough; the mouth is wide open; the voice is hoarse; the thirst great; strange horrors, starting, and wild looks, at the sight of water; a frothing at the mouth; an involuntary inclination to spit at the by-standers, as also to bite them, which the patient cannot resist. He foams at the mouth, and gnashes with his teeth; and would do mischief, if not forcibly withheld. His pulse and breathing fail: there is a cold sweat, and the highest fury: yet during all this time, which is wonderful, the patient continues in his senses, and is afraid of doing any harm. On the fourth day from the first degree of the disease, the patient falls into convulsions, with great difficulty of breathing; and then dies.

The dissection of persons who died of this disease has shewn, that the organs of swallowing have been in some measure inflamed; that various kinds of bilious viscidities are collected in the stomach; that the gall-bladder is full of

of a black bile; that the pericardium is dry; that the lungs are incredibly distended with blood; that the heart is full of an almost dry blood; that the arteries are full, and the veins almost empty; that the blood is very fluid, and will hardly coagulate when exposed to the air; whereas that which was drawn from a vein three days before, coagulated as usual; that all the muscles, viscera, brain, cerebellum, and spinal marrow, are more dry than common.

The prevention and cure of this disease, except in a few instances, are very doubtful and uncertain: which may be attributed to the boasting pretences of some to specifics, and the neglect of a due method of cure, founded on the history of the disorder.

So far therefore as may be conjectured from the preceding history of the disorder, and from comparing it with other diseases, as also from the few instances which have been attended with a happy event, it seems chiefly to consist in an affection of the nerves, which most nearly resembles convulsions, which occupy the viscera and the vessels thereof; whence arises a disorder in the blood and humours, which is not unlike a gangrenous inflammation. The seat of the disease is chiefly about the stomach and the neighbouring parts.

The preventive cure consists in making deep scarifications, as soon as possible after the bite, in the part affected, and those adjacent to it; that they make a considerable discharge of blood, and apply large cupping-glasses thereon; or it may be burnt pretty deep with an actual cautery. Then it should be made to suppurate by some corrosive application proper for that purpose; and during all that time it should be continually fomented with a pickle made with vinegar and salt: this should be continued for six months at least. The garments he had on at the time of the bite should be cautiously laid aside or destroyed. He should likewise with all convenient speed be dipped in a river, or the sea, making him believe that he is going to be drowned. This is to be often repeated; for the effect consists in terrifying the mind, not in the salt-water, as we have learnt from experience. Then he should also be often and strongly purged with rhubarb, agaric, and the juice of elder-bark.

The patient should also be put into a sweat every morning fasting, with a mixture of aromatic vinegar, sea-salt, and hot water. His feet and hands should also be daily fomented in a warm bath; and he should wash his head, mouth, and fauces.

Let him often drink cold water, and throw it up again by vomiting; and let his drink be acidulated. His aliment should be moist, light, and laxative, and often taken in such a quantity as to vomit it up again. He should likewise abstain from things that are too spicy, from wine, from heating things, from violent exercise, and from commotions of the mind.

The cure should be attempted when the disease is in the first degree, and in the beginning of the second, by treating it as highly inflammatory, by letting blood from a large orifice even to a deliquium, by giving clysters soon after with nitrous or moderately salt water.

After this let the patient be blind-folded, and thrown into a pond of cold water; or let cold water be thrown

upon him till the dread of it almost ceases; then let a large quantity be forced down his throat: let this be his treatment daily, and at night let sleep be procured. And this method is better than that pernicious one of giving him the most acrid heating and drying medicines; which exasperate the nervous system, and are in this case as bad as poison, to a patient already almost parched with heat.

Celsus informs us, that it was the practice of old to put the patient bit by a mad dog into a bath, and there to let him sweat as long as his strength will permit, at the same time keeping the wound open, that the virus might be discharged from it; and then to give him plenty of good generous wine. This being done for three days, they judged him out of danger.

This may give some light into the nature of the pulvis antilyssus published by Dr. Mead, and received into the dispensatory of the college, wherein pepper is one of the ingredients:

1. Take four drams of ash-coloured ground liver-wort, and two drams of black pepper, beat into a powder.

This is to be divided into four doses, whereof one to be taken in warm milk in a morning, fasting, for four mornings successively. After this he is to be put into a cold bath, pond, or river, for thirty days together, early in the morning before breakfast.

Another famous specific is the East-india medicine; which is doubtless an egregious antispasmodic, and is as follows:

2. Take native and factitious cinnabar, of each 24 grains, and 16 grains of musk. Make them into a powder.

This is to be taken in a tea-cup full of arrac or brandy, and is said to secure the patient for thirty days, at the expiration of which it is to be repeated; but, if he has any symptoms of the disease, it must be repeated in three hours, which is said to be sufficient for a cure.

Dr. Wall of Worcester has found two doses of musk, of xv grains each, to produce very happy effects on two persons labouring under a subfultus tendinum, with extreme anxiety, and want of sleep, from the bite of a mad dog; for it perfectly relieved them from their complaints. We have a singular case of a woman actually seized with an hydroprobia, given by Dr. Nugent; who was cured. He ordered this powder to be taken in honey every three hours, after she had lost 15 ounces of blood, and a pill of 2 grains of pure opium along with the powder, till rest was procured.

### Of Poisons.

There are three essential marks of poisons which distinguish them from other things that are noxious to human bodies. The first is, that they consist of most subtle parts, and consequently are pernicious in a small quantity. The second, that they pervert, in a short time, the regular motions of the solids and fluids throughout the body, and induce the most grievous symptoms, even death itself. And the third, that they exercise their cruelty on the most subtle fluid, and the most nervous parts.

All the three kingdoms have poisons peculiar to themselves; but the animal kingdom affords the most subtle, which are communicated by the bite of mad or venomous

ous beasts when they are angered. The mineral kingdom produces arsenicals and mercurials; and the vegetable, herbs and plants, of a most acrid, noxious and deleterious quality, such as the most violent cathartics and narcotics.

Every sort of poison seems to have an effect peculiar to itself: thus mercury attacks the fauces and their glands, producing ulcerations therein; arsenic occasions the most cruel torments, convulsions, and mortification of the coats of the intestines; the seeds of datura, a kind of stramonium, induce madness or absolute stupidity; hyosciamus causes a stupor, and so troubles the imagination, that the person affected believes he sees dæmons and spectres. Opium brings on sleepiness, and a torpor on the mind. Sharp, drastic purges inflame the intestines. The bite of a mad dog occasions the dread of water. The sting of a scorpion produces a sudden and exceeding cold sweat. Litharge, unwarily taken, causes a convulsive colic, with an obstinate costiveness. The berries of deadly night shade produce madness, rage, or folly; as do also the roots of cicuta terrestris.

The bites of mad animals have been already treated of: and, as for others, it appears from experience, that the bites or stings of other animals, such as spiders, scorpions, and vipers, are most pernicious in hot countries; and neither the insects, nor any other animals, are poisonous of themselves, but their stings or bites, when they are mad, or provoked to anger.

The venom of animals, whether in a rage or madness, communicates an infection by the saliva, milk, and lymph.

The symptoms which follow the bite of a viper, are a sharp, pricking pain in the wounded part; a tumour, which is first red, and afterwards livid, sensibly extending itself to the neighbouring parts: the skin frets, and breaks out into little bladders: some time after, a remarkable faintness supervenes, with a quick, weak, and sometimes an intermitting pulse, a palpitation of the heart, a stupefaction of the senses, an anxiety of the præcordia, a great sickness of the stomach with bilious vomiting, a dulness of sight, sometimes pains about the navel or the region of the liver, difficult breathing, hiccups, tremblings, convulsions, cold sweats, coldness of the extremities; after which, death closes the scene, unless prevented by timely remedies. If the patient survives, a tumour with inflammation continues for some time. Sometimes a sanies flows from the wound, and pustules appear, like the herpes exedens; the skin becomes yellow, as if the patient had the jaundice.

Hoffman observes, that externally in all venomous bites it will be proper to apply such things as relax and mollify the strictures of the parts, that open the pores, and so procure an exit for the virulent matter.

Boyle observes, that a hot iron held over the wounded part, immediately after the bite, so checks and weakens the venom, that the patient will have nothing to complain of but a pain in the part of short continuance.

But, above all, Mead, from many experiments, recommends the fat of vipers, which, being rubbed into the wounded part, renders all others useless; and, if that is not at hand, it appears from some late trials, that common fallad-oil, rubbed warm into the part, will do as well.

The bite of a RATTLE-SNAKE, hitherto looked upon as a most terrible accident, may now be cured in a simple, easy manner. It is the invention of a negro; for the discovery of which, he had his freedom purchased, and an hundred pounds per annum settled upon him during his life by the general assembly of Carolina.

Take of the roots of plantane and horehound (in the summer the roots and branches together) a sufficient quantity; bruise them in a mortar, and squeeze out the juice, of which give as soon as possible one large spoonful; if the patient be swelled, you must force it down his throat. This generally will cure; but, if he finds no relief in an hour after, you may give another spoonful, which never fails.

If the roots are dried, they must be moistened with a little water. To the wound may be applied a leaf of good tobacco moistened with rum.

The mineral kingdom furnishes very few real poisons: the only natural one is cobalt; the fastidious are arsenic, corrosive sublimate, and glass of antimony.

Cobalt is a kind of a marcasite, which is found in great plenty in the mines of Misnia; and is well known for its poisonous quality, so fatal to insects, brutes, and men. In making the blue glass, or enamel, called smalt, from this mineral, a sort of white flowers arises, which, being melted in a stronger fire, is called white arsenic. If this be melted again with an eleventh part of sulphur, it becomes yellow arsenic, and, with a sixth part of sulphur, red. Of these, the white is the most deadly poison.

As for the true mineral poisons, they were entirely unknown to the ancients; for they reckoned quicksilver, crude antimony, all kinds of vitriol as well as cerufs, and the lapis lazuli, in that class; but orpiment, which they called arsenick, as Celsus testifies, and looked upon as a poison, is void of all virulence and deleterious qualities; and sandarach they termed red arsenic, which is made of melted orpiment, but is no more noxious than the former. Indeed, it must be owned, that the above catalogue are not altogether friendly to human nature, or may be ended with a corroding quality; but they want the true characteristic of poisons.

Quicksilver, dissolved in acid mineral spirits, is likewise a poison, though of itself it is entirely innocent. This has chiefly appeared from errors in practice, when the mercury has not been rightly prepared and corrected.

Likewise glass of antimony reduced into powder, and exhibited, causes enormous vomiting, with most cruel gripings, which often end in death.

Arsenic, taken inwardly, creates a pricking, vellicating, irritating, burning sensation, with a heat and most violent pain in the stomach, a racking torture in the bowels, vomiting, unquenchable thirst, a roughness and dryness of the tongue, fauces and gullet, with hiccups: then follow most cruel anxieties, palpitation of the heart; fainting, coldness of the extremities; sometimes black vomits, and stools with a fetid cadaverous smell; a gangrene and mortification of the stomach and intestines, which usher in death.

Milk is very useful against all corrosive poisons, by its soft, oleous texture, blunting their acrimony; and is a good vehicle to bring them up by vomit.

In all cases where a person is suspected to have been poisoned by swallowing any substance of a corrosive nature, oil with milk for a vehicle yields the most certain relief; and even when acid mineral spirits are taken by mistake, they will blunt or sheathe the acrimony sooner than fixed salts and testaceous powder will change their nature: besides, fallad-oil is generally at hand in all places as well as milk; and the sooner it is given, the less is the danger.

The most dangerous vegetable poisons, are wolf's-bane, the deadly night-shade, henbane, and datura; to which may be added the roots of oenanthe cicutæ facie, or hemlock dropwort, cicuta vulgaris or common hemlock.

Hoffman affirms, that milk in a large quantity is an universal remedy against all poisons that kill by inflammation, and if taken in time will prevent the direful consequences. Allen thinks a vomit with warm water and oil, taken in large draughts and often repeated, will be of great service; as also warm water with fresh butter, milk and oil, or milk and butter. If the above things will not provoke the patient to vomit, oxymel of squills, salt of vitriol, or a decoction of tobacco, may be used, as having a more immediate effect. It is hardly safe to give even the most gentle cathartic.

The stomach being thus emptied of all, or as much as possible, recourse must be had to generous wine and alexipharmics, such as venice-treacle, confectio alkermes, the bezoardic powder, &c. When there is a suspicion that the coats of the stomach or intestines are corroded or ulcerated, it will not be proper for the patient to use spices or vinegar, nor to indulge in too much wine, but to take a decoction of barley with raisins, or a decoction of china-root, saffaras, &c.

The same method is most likely to answer when any other deleterious herb or root has been eaten by mistake, though the particular species should not be known; and Hoffman affirms, that when the patient has been stupified by the narcotics, the best remedies are vomits mixed with oil, to facilitate the operation.

#### *Of a GUTTA SERENA.*

A *GUTTA serena*, or amaurosis, is an abolition of the sight, when no fault appears in the eyes, except in the pupil which is larger than usual and more black, nor will it contract, though any luminous object is placed directly before it, but continues quite immoveable. It may be distinguished from the disorder of the eyes proceeding from the vertigo; for the objects seem to turn round: From a cataract; for then an opacity of the crystalline humour is perceivable, and the pupil will contract in a glaring light.

When this disease comes on suddenly, it generally proceeds from external causes, as blows, falls, and the like. When it comes on by degrees in old persons, it arises from a hemiplexy or palsy; as also in other weak and languid constitutions. Sometimes its concomitants are pains in the head, the vertigo, sleepiness, noise in the ears, and sometimes it comes on without any preceding symptoms.

From dissections it has appeared, that the optic nerves have been in fault; that is, they are wasted away or much less than common; as also compressed by extravasated fluids, or hard tumours about their origin.

The indications of cure are, to discuss the stagnating humours, which compress the nerves, and then to strengthen the affected parts.

Heister affirms, it is to be cured by aromatics, carminatives, and attenuants; chiefly eye-bright, veronica, hyssop, rosemary-flowers, sage, fennel, and aniseeds, valerian root, saffaras, cinnamon, wood-lice, either in infusion or powder: the juice of wood-lice newly expressed, and taken for some weeks, increasing the dose, is of excellent use; as likewise mercurials, taken in very small doses, and a long while together.

If it arises from a suppression of usual hæmorrhages, they are to be restored; but, if this cannot be done, artificial bleeding is to be substituted.

Externally, issues are held to be good, clysters and setons, especially in the phlegmatic. The eyes may be washed with fennel, valerian, eye-bright, or rose-water, spirit of wine, Hungary water, and sal-volatile oleosum diluted, or an infusion of fennel-roots in wine, with bags of strengthening herbs and fennel-seeds often put thereon. Sneezing powders may likewise be proper, especially florentine orrice, or horse chestnuts; likewise spirits of hartshorn, or sal-volatile oleosum, may be applied to the nose.

In all disorders of the eyes, but particularly in this, the body must always be kept open, that the humours may be invited downwards, with laxative pills mixed with calomel. Likewise strong clysters are of very great use.

#### *Of a SUFFUSION, or CATARACT.*

A *SUFFUSION*, or cataract, is an obstruction of the pupil, by the interposition of some opaque substance, which diminishes or extinguishes the sight: Some are thicker than others; some are white, black, citron-coloured, or brownish. It is always contained between the uvea and sclerotica, where it sometimes swims and fluctuates like a bit of lawn in the aqueous humour, and sometimes it adheres close to the coats. It is generally an opacity of the crystalline humour.

The medicines above mentioned, in an incipient or recent cataract, from thick or viscid humours, may do good, especially if they arise in the crystalline humour, as Heister affirms, because they attenuate, resolve, and render the humours fluxile, and increase the spirits. A grain or two of mercurius dulcis, given with twice the quantity of prepared oyster-shells for thirty days together, has destroyed the rudiments of a cataract. But, if these have no effect, and the cataract grows inveterate, ripe, or perfect, it is to be depressed; for which, see *SURGERY*.

#### *Of a GLAUCOMA.*

A *GLAUCOMA* is a change of the crystalline humour into an azure colour, from its dryness and condensation, as some affirm: but Heister says, it arises from an opacity of the vitreous humour, which becomes of a whitish green colour; for, in a suffusion, an opaque body is placed behind the pupil, or is next to the uveous part.

Sennertus says, this malady is known from a very remarkable whiteness appearing in the eye, and lying deep behind the pupil, and all things are seen as through a smoke or cloud; it is said to be incurable.

*Of the AMBLYOPIA, or Obscurity of Sight.*

THE amblyopia is an obscurity of sight, and is four-fold: myopia, or short-sightedness; presbytopia, or seeing only at too great a distance; nyctalopia, or seeing only in the night; amaurosis, of which before.

Myopia proceeds from the too great convexity of the cornea, or crystalline humour, or from the eyes being larger than common, as we learn from optics. This is best assisted by concave glasses.

Presbytopia proceeds from the contrary causes, and receives assistance from glasses of a convex form.

Nyctalopia is a twofold malady, in which the complaints are contrary to each other. In the first species, the sight is best in the night, and in obscure places; but in a clear light the sight fails, and they can hardly see any thing at all. In the other sort, which is improperly called a nyctalopia, they see nothing at all, except in a clear and bright light. This infirmity arises from a naturally bad formation of the eye, and is therefore incurable. The presbytopia may likewise be assisted by cephalic and strengthening medicines, by watery and vinous infusions, and comforting eye-waters.

*Of a STRABISMUS, or Squinting.*

A STRABISMUS, commonly called squinting, is an unequal contraction of the muscles of the eye, either from a spasm, an epilepsy, or a palsy, whereby the axis of the pupil is drawn towards the nose, temples, forehead, or cheeks; so that the person cannot behold an object directly. Infants readily contract this distemper, sometimes for want of care in the nurses, who place the cradles in a wrong position, with regard to the light. Children likewise, while growing up, sometimes fall into this disorder, either from ill customs contracted in playing, or by looking on others who are affected with it.

This disorder is very difficult to cure; therefore the utmost care should be taken to prevent it, and the cradle should be so placed, as not to occasion the child to look a-wry. Ægineta contrived a mask, and so adapted it to the face, that nothing could be seen except through two holes straight forward; and for the same purpose what we call goggles are used.

*Of the ALBUGO, or Spot in the Eye.*

AN Albugo, or leucoma, is a whitish spot of the transparent cornea; the broader and thicker it is, the more it obscures the sight; when it is superficial, it appears the whiter; and, when it is deeply rooted, it tends to blackness, and is scarce curable. That which is in reality a cicatrix, or scar, left after a wound or ulcer in the eye, is very difficult to be dissipated; that which follows an inflammation of the eye often goes away of its own accord.

It may be distinguished from a cicatrix, because this is of a shining white and without pain; whereas the albugo looks like chalk, is attended with a slight fluxion, and some degree of an inflammation with pain. It is generally the forerunner of an ulcer.

The intentions of cure are answered by emollients, resolvents, and discutients, which must be used with great

caution. To take away a cicatrix, the sharpest topics, nay, cathæretics, are sometimes to be used, with a very prudent hand: but, first of all, mild things may be tried; and, if they fail, we may proceed to stronger.

*Of a SUGILLATION, or Bloodshot Eye.*

A SUGILLATION first appears of a reddish colour, and afterwards livid or black. It is caused by a stroke or fall, or violent vomiting, whereby the blood is extravasated in the coats of the eye. If the cornea is affected very much, all objects appear of a reddish colour; for some veins run to the cornea, in the part towards the iris, or the blood may be poured out into it from the neighbouring vessels.

If the disorder is great, there will be occasion for bleeding and purging, for the grumated blood in the sugillation is to be resolved and dissolved, which may be done by discutients, such as juice of fennel, with balsam of Peru, juice of celandine, simple honey-water, mixed with other eye-waters.

If from this or any other cause there should happen to be an ulcer of the eye, Demours recommends coarse sugar as a good ingredient for deterring those of the cornea, in which astringents are hurtful; but it must be mixed with collyria. When the aqueous humour of the eye is evacuated at a wound or ulcer of the cornea, he exposes the patient to the light, from time to time, till the cornea is again raised by the aqueous humour; for the light occasions a motion in the iris, which may prevent its adhesion to the cornea.

*Of the EPIPHORA, or Lippitude of the Eyes.*

AN epiphora is a defluxion of a salt sharp humour upon the eyes, attended with itching, pain, and redness; as also a dimness of sight. It is but slight when there is no defect in the bulb of the eye, when the eye-lids swell and look red, when the matter of the fluxion is thick and sometimes glues the eye-lids together in the night, continuing in this state for some time.

Children are often afflicted with this disease, particularly those who have had a scald-head improperly cured; or who have swellings in the glands of the neck or about the ears, and then it cannot be cured until these tumours are dissolved. It sometimes likewise succeeds the small-pox and measles.

The seat of this disease is in the glands of the eye, especially in those called the lachrymal glands.

This disease may be certainly cured in the beginning, by a plentiful drinking the infusion of the leaves of veronica, in the manner of tea, for some time. When it is inveterate, the patient must be very regular in his diet, and must avoid every thing salt, sharp, acid, wine, strong-beer, and drams. His common drink may be a decoction of hartshorn and fennel-seeds, using warm pediluvia at night going to bed.

Externally a grain of vitriol may be mixed with unsalted butter, to which a small portion of sugar of lead may be added and put into the greater corner of the eye. This is a most useful medicine. When the lippitude is of the dry kind all acid applications must be avoided, and the eyes must be covered with a poultice of white bread

bread and milk, with a little saffron mixed with it. The success of ferons and issues is uncertain, but a perpetual blister on the nape of the neck is of great service. But it must be continued for a considerable time.

*Of the FISTULA LACHRYMALIS.*

THE fistula lachrymalis is a disease which attacks the great caruncle in the inward corner of the eye, and stopping up the natural passage of the tears, forces them to run down the cheek: but this is the first degree of the disease. The second is, when pus is mixed with the tears, which proceeds sometimes from an opening in the skin between the nose and the great corner of the eye. The last is, when the pus has not only corroded the neighbouring parts which are soft, but has affected the bone which lies underneath. This sort of fistula sometimes turns cancerous; and Riverius advises not to meddle with it at all.

Whatever may be the cause of this disorder, whether the small-pox or the French disease, it always stops up the nasal conduit, which is opened by an operation. See SURGERY.

*Of DEAFNESS.*

THE causes of deafness are a cutting off the external ear, or an obstruction of the auditory passage from wax or other things; from a rupture of the membrane of the tympanum, or when it is corroded or ulcerated, or the auditory nerve is obstructed or compressed. External causes are, falls from high places, excessive noise, such as the explosion of cannon; likewise acute disorders near their state, which are like to terminate by a critical hæmorrhage.

As to the prognostics, those who are born deaf are rarely cured. A real deafness is hard to remedy. A deafness in acute diseases, with crude urine, foretells a delirium; but, when the signs of coction are good, it portends a critical hæmorrhage.

With regard to the cure; if the obstruction be in the external cavity of the ear, it is discernible by the sight. If there is occasion to syringe the ear, a decoction of sage and rosemary-flowers will be proper, with equal parts of water and white-wine; but great caution should be used. Some pump the head with warm bath waters. Some say, the eggs of ants bruised and put into the ear, with the juice of an onion, cure the most inveterate deafness. Others affirm, that a salivation will sometimes perform a cure.

A critical deafness will cease of itself. Etmuller recommends amber and musk.

Hoffman says, deafness sometimes arises from a slackness of the auditory nerves, which often happens from too great a humidity, which, if neglected, will terminate in a perpetual and incurable deafness, and may be dispersed, if taken in time, by proper cephalics and sudorifics. Some for this purpose recommend equal parts of spirit of lavender and hungary water, which should be dropt warm into the ear. Lindanus advises the gall of an eel mixed with spirit of wine; and others, the fumes of sulphur conveyed into the ear, with a pipe or funnel. But regard must be had to the cause, if discoverable.

*Of a TINNITUS, or Noise in the Ears.*

HOFFMAN observes, that this is caused by the spasms of the coats of the ear, which line the inward parts, such as the labyrinth, cornea, and auditory passage, which is often attended with intolerable anxiety.

The cure is to be performed, says Heister, by temperate diaphoretic powders, and resolving essences, commonly called anticatarhales; as of amber, the woods, rosemary; together with diaphoretics and alexipharmacs, taken often in a day, with tea of betony, with rosemary flowers, sage, or lavender and saffras. In the morning, and at noon, the essences are to be taken; and at night the powders.

Outwardly, essence of amber may be applied, either alone, or with a few drops of oil of amber, or one or two drops of camomile put into the ear with cotton, morning and evening; or a grain or two of amber and musk, or castor in cotton, either alone or with Peruvian balsam; or carminative oils, such as anise, fennel, carraways, or calomel; not neglecting pediluvia, and frequent rubbing of the feet and head.

*Of a CORYZA, or Catarrh of the Nose.*

A CORYZA is too great a moisture of the nose, by a thin sharp serum, which gradually becomes thick, and sometimes coloured.

The cause of this disorder proceeds from the lymph and mafs of blood, most commonly in the winter-time, which hurts the nostrils; at first it arises from a thin, sharp humour, which excoriates the parts, which, becoming more thick, almost stops the nostrils and hinders breathing. Sometimes it arises from sternutatories too often taken, and from mineral fumes; this is accompanied with spitting and a cough. Sometimes the effluvia, affecting the nostrils, have the nature of a ferment, and become infectious.

As to the prognostics, it is without danger, unless the lymph is exceeding sharp and ulcerates the nostrils, and so degenerates into an ozæna, or fordid ulcer of the nostrils. Hoffman says, this excretion is often salutary, and is exasperated by purges.

With regard to the cure, the irritation is to be stopped in the beginning, by joining laxatives with sudorifics, according to the condition of the patient, the season of the year, and the reigning diseases. To stop the irritation, oil of aniseed is very proper; but if the nostrils are red, painful, and excoriated, it must be mixed with barley-flour well dried. Camphor dissolved in oil of almonds is likewise good externally applied, and the smell of horns when rasped, as well as the vapours of gum-anime, received into the mouth and nose. The vapours of amber, frankincense, mastic, and benjamin, are likewise useful. A coacervation of the mucus may be evacuated by distilled oil of marjoram, amber and aniseed, mixed with leaves of marjoram, and made into snuff; or, by a sternutatory of calcined white vitriol, twelve grains of which may be mixed with two ounces of marjoram water, and filtrated. If the nostrils are obstructed, the vapour of vinegar upon hot iron will be profitable. If the head is heavy and dull, the vertex should be anointed with balsam of Peru, which  
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may be made stronger with oil of amber. To preserve the mouth, troches may be held therein, made with mithridate and olibanum.

To preserve the fauces and windpipe, it is common to take raisins steeped in spirit of aniseed.

*Of the OZENA.*

THE OZENA is a fordid ulcer affecting the nostrils; wherein the humour is very acrid or corrosive, intolerably fetid, sanious, and often mixed with a bloody mucus.

With regard to the cure, the leaves of tobacco, or tobacco ointment, are very useful: If it gathers to a crust, it may be removed by oil of sweet almonds. Some make use of the fumes of cinnabar, or inject mercurius dulcis; others use precipitate mixed with an emollient ointment, and applied with tents. Some use an injection of oil of sweet almonds, an ounce with a dram of oil of castor to soften the acrimony of the humours. If the pain be great, they add a scruple of camphor and saffron, with half a scruple of opium. To take away the crust, they make a powder of rosemary and lavender flowers, dried lemon-peel, and common snuff.

When the matter is well digested, the running abated, and the pain gone, it may be cicatrised with lotions, and washed with warm milk.

*OF WATCHING.*

WATCHING is produced by too great a determination of the nervous fluid to the organs of the senses: from its too great influence in the brain, while the lower parts are obstructed with colds or other causes, as in hypochondriac, melancholic, and mad patients, whose lower parts are cold: by any irritating body, in whatsoever part it is placed, which disturbs the senses, and especially the brain: from too great a motion of the humours, while the passages of the brain are open: from disorders, in which the causes above-mentioned are predominant; as fevers, phrensy, melancholy, pains, suppurations, and such-like disorders.

When the cause is known, it must be removed, if possible; and the irritated spirits must be appeased with emulsions, especially of poppy seed, or with the thebaic tincture, or theriac and other opiates in general, not neglecting the original diseases. In fevers, a moist softening diet is beneficial; as also preparations of barley, emulsions of poppy-seeds, and almonds, decoction of scorzonera-roots, almond cream, and winter-flummary, used as aliment; likewise tea made of cowslip-flowers, and gentle laxatives. When the patient is restless and wakeful the night before a crisis, no hypnotics should be given.

When there is no other disease, the patient should shun all care, and intense thinking, especially in the evening; he should use exercise, and eat light suppers. If it is caused by pains, they should be appeased by antispasmodics, things which temperate, and diaphoretics: if these will not do, mild opiates must be added. In old persons, all care and sollicitude should be banished, the mind should be quiet, and the moderate use of generous wine may be allowed in the evening; likewise medi-

cines of amber and musk will be proper, and confectio alkermes or theriaca with wine. The drinking of hot-water, and principally coffee, must be forbid after dinner.

*Of the INCUBUS, or Night-mare.*

WILLIS observes, that the incubus rarely seizes any one, except during sleep, and when the stomach is oppressed with aliment of hard digestion, especially if the patient lies on his back.

Those that are seized with it, seem to have a heaviness on their breasts, and about their præcordia; and, if they want to speak, they cannot: Sometimes they see spectres of various forms, and cannot get rid of the load, or move their body, but after a long struggle: at length they awake, and the imaginary weight vanishes; but sometimes they find a tremor of the heart, and many times a quick and violent vibration of the diaphragm.

Heister observes, that those who have troubled dreams, or walk in their sleep, are to be cured in the same manner, as proceeding from the same cause, and should purge, bleed, and use a spare diet.

Et-muller is much of the same opinion, and advises the patient to eat slight suppers, and to lie with their heads raised pretty high. If it be very troublesome, anti-epileptics may be used, as well as medicines prepared of steel. It frequently affects children, because they eat more than they can digest. There are some instances of its being mortal; though it is generally without danger. Dr White has proved that the incubus is owing to wind in the stomach and bowels; and therefore recommends a dram of brandy before going to bed.

*Of the SYNCOPE, or Fainting.*

HEISTER observes, that this disorder may arise from want of strength from profuse bleeding, from sudden and violent terror and dread, or from the sight of any greatly affecting thing. The patient is deprived of sense and motion, either wholly or in part, with paleness of the face, and a very weak or low pulse. They are generally roused by shaking and pulling, or by volatile medicines; which distinguishes it from the apoplexy.

There are two kinds; the one slight, the other grievous. The slight kind is attended with paleness of the face, disturbed vision, ringing of the ears, and sometimes with a vertigo; the strength fails, and the patient is almost deprived of sense, falls or sinks down, till some proper remedy is applied to the nose and mouth. The more grievous sort is, when the patient falls into a delirium, and is deprived of all sense and motion, except breathing, and a very small pulse; but yet he may be roused by spirituous medicines and other means, much more easily than in the apoplexy.

Besides the causes already mentioned, there may be added the hysterick passion, which seems to proceed from spasms; some of this sort are thus affected with the smell of sweet things. Some incur this disorder by deep study, great inanitions, and fasting.

With regard to the prognostics, it has generally more terror than danger attending it, unless it proceeds from profuse bleeding, or wounds, or a loss of strength by o-

ther diseases, or a most violent terror. The slighter fainting-fits have little danger; and patients are brought to themselves by volatile medicines, taken by the mouth, or applied to the nostrils.

As to the cure, if the slighter sort happens when a vein is opened, or from the sight of blood, wounds, ulcers, or any surgical operation, which proceeds from horror and fear, affecting the imagination, it often happens that changing the room, and going into fresh air, will perform a cure. But if any thing hinders this, that they can neither walk nor leave the room, the smell of hungary water alone, or volatile spirits, or wine and strong vinegar, or sprinkling the face with cold water, or a draught of generous wine, will bring them to themselves.

In more grievous fainting fits, where gentle cordials are of little use, the stronger sort must be applied, such as spirit of sal ammoniac to the nostrils, temples and pulses, with strong frictions; or 40 or 50 drops of volatile spirits may be given inwardly, to which may be added cinnamon water, orange-flower-water, or the like; not forgetting a draught of generous wine, with vellications and frictions of the extremities of the nose, ears, head, hair, &c. till they recover.

When the patient is hyseric, none but fetid things should be applied to the nose, such as castor, asa-fœtida, partridges feathers burnt, or burnt leather, horn, or the like; as also fetid spirits, in a grievous fit; not omitting vellications and frictions of the aforesaid parts.

#### *Of the SPASM of the LOWER JAW.*

In the spasm of the lower jaw, when the patient can neither open his mouth, nor eat, as when persons are wounded, and something foreign is lodged therein, or when the nerves are hurt, or when sharp things, such as vitriol, are applied to stop the blood, the cure must be performed according to the diversity of causes, as particularly treated of in surgery. But when this happens spontaneously in infants, they generally die, though the best nervous and antispasmodic medicines have been used both inwardly and outwardly.

#### *Of the CYNIC SPASM, or Convulsion of the Muscles of the Mouth.*

A CYNIC spasm, if it proceeds from vegetable poisons, as it generally does, they are to be expelled immediately from the body by a vomit, and then giving generous wine, warm with ginger or pepper. If it happens from other causes, it must be treated with antispasmodics and nervous medicines, both inwardly and outwardly; and chiefly with plaster of betony and bay-berries, prepared with oil of amber, and applied to the temples, and behind the ears.

#### *Of the PALPITATION of the HEART.*

THE heart often palpitates so much as to be heard at a distance by the bystanders, which they suppose to be an affection of the thorax. This may sometimes happen, from a violent motion of the body, chiefly when ascending high places, and principally in those who are plethoric and hypochondriac. Sometimes it is caused by fear or dread, when the blood is forced too violently to the heart. When it proceeds from violent motion or terror, and re-

turns often, it causes a kind of polypus, as is evident from the dissection of those bodies who have died of this disease. Hence, almost a continual palpitation arises. Sometimes it proceeds from a bad conformation of the heart and the neighbouring vessels, such as an aneurism of the aorta, when it becomes boney.

Others affirm, it sometimes may be caused by wounds in the ventricles or abscesses in the heart; or from wind, or a disorder of the animal spirits, inducing spasmodic affections.

In the beginning of the cure, if the patient is plethoric, or when usual bleedings have been stopt, it will be proper to bleed, by way of preservation, in the spring and autumn.

Besides this, saline, nitrous, and cinnabarine temperating medicines are to be used, particularly antispasmodics, to appease the motion of the heart, and render the blood more fluid. The aqueous infusions of tea, balm, veronica, primroses, or citrons, are likewise proper, especially with the essence of scordium, carduus benedictus, citron, or orange-peel, with a little dulcified spirit of nitre, taken morning and evening; as also temperate pediluvia, moderate frequent exercise, riding, moderate diet, plenty of thin drink, whey, mineral waters, especially the chalybeate kind, are very useful in this disease.

#### *Of a POLYPUS of the HEART.*

A POLYPUS is a mass composed of various pellicles and fibres, generated in the heart and large vessels. They are generally founded in acute as well as chronic diseases; and there are few bodies to be met with, wherein they are not to be found after death. Its principal seat is in the heart, pulmonary artery, and the aorta.

They principally attack the sanguine constitutions, and patients who have smaller vessels, soft fibres, of a sedentary life, who drink little, or are free in the use of acid wines and spirituous liquors, as also those who eat large suppers.

The beginning of a polypus may be known by a compression of the breast, a fixed pain about the heart, and when it increases there is a frequent palpitation of the heart, from a slight cause, and the pulse is strangely unequal and often intermits. When there is a violent motion of the body, or the patient has taken a medicine which disturbs the blood, or the mind is violently affected, a shortness of breath and an incredible anxiety of the heart will arise. Lastly, there are frequent faintings without any evident cause, or from a certain position of the body. If the blood is let fall into hot water, it will congeal like jelly, and cleave into white filaments.

In the cure, an exact regimen and diet must be made use of, with a frequent exercise and motion of the body, and mineral waters, especially those of the chalybeate kind, and abounding with alkalious salt.

#### *Of the HICCUP.*

A HICCUP is a spasmodic affection of the stomach and diaphragm, arising from any thing that irritates and vellicates their nervous coats. When it proceeds from a slight error in diet, it will soon end spontaneously, or by drinking any thing which dilutes the acrid matter. Sometimes

it is of a more grievous kind, and may proceed from a hurt of the stomach, poison, an inflammation of the stomach, intestines, bladder, diaphragm, or the rest of the viscera. Sometimes, immediately before death, it may proceed from gangrenes of the outward parts. In acute fevers, and chiefly the malignant, a hiccup is frequent, and often fatal.

When it happens in old or weak persons, from a plentiful meal, especially from hard and flatulent aliment, a draught of generous wine, or a dram of any spirituous liquor, will generally take it away. Likewise stomachic powders mixt with Peruvian bark, and taken in generous wine, are profitable; as also if it proceeds from cold, or drinking cold liquors.

When it proceeds from other causes, especially from acid humours in the stomach, absorbent and alkalious medicines are good. If it proceeds from an acute fever, or an inflammation of the stomach, it is a dangerous disease. However, dulcified spirit of nitre, joined to an alexipharmac, and given often, is proper; a dram or two of diascordium, given in the evening, may perform a cure. If it proceeds from a gangrene or mortification, it is generally incurable; but Peruvian bark, with medicines against internal inflammations, is most likely to succeed. If a poison is the cause, plenty of milk must be taken with oil, as has been already taught.

#### *Of the SODA, or Heart-burn.*

THIS disorder is a heat or troublesome burning about the pit of the stomach, or its left orifice, which sometimes is extended the whole length of the oesophagus, with a pressure or spasmodic constriction, usually attacking the patient by fits. The cause is generally fat aliment, if cold drink be taken soon after. In some it proceeds from acids, in others from aromatics, spirituous liquors, or bilious humours. It frequently torments pregnant women. This disorder is generally slight, and vanishes of its own accord; but in some it is of long duration.

In the cure, the cause must always be attended to: If from acids, absorbents are proper, particularly crabs-eyes and prepared shells, mixed with a fourth or fifth part of powder of nutmeg, given to half a dram. It is common to take chalk alone, or mixed with nutmeg; but care should be taken not to be too free in its use. Oil of tartar *p r deliquum*, given from 20 to 30 drops, in tea, coffee, broth, or warm beer, is usually efficacious; as also tincture of tartar and spirit of hartshorn. If it proceeds from bilious humours, 30 or 50 drops of dulcified spirit of nitre in-water, tea, or coffee, will take away the pain. When it is caused by fat things, and draughts of cold liquor, a dram of brandy is good. Now and then laxatives should be given, to carry off the humours. In sanguine constitutions, bleeding may be proper.

#### *Of the CARDIALGIA, or Pain of the Stomach.*

OF all pains of the stomach, the cardialgia is the most severe. It is a spasmodic pain of the orifice of the stomach, sometimes of the right and sometimes of the left. One kind of this disorder may proceed from a sharp caustic, or poisonous matter; sometimes it arises from a redundant or caustic boil, or from a dysentery. At other

times it may proceed from the blood, when any usual evacuations are suppressed, and the nervous membranes of the stomach are distended thereby. Hence it often happens to women after the fiftieth year; and, in the cure, bleeding or scarifications are proper: on the other hand, if it is deduced from a caustic matter in the stomach, oily appeasing things, asses milk, an infusion of camomile flowers, cream, with absorbents, are proper. It must be distinguished from a painful inflation of the stomach, in which there is a tumour like a bladder under the false ribs, chiefly on the left side, and under the pit of the stomach; but the inflation is generally on the right side, with great difficulty of breathing. This is common in infants before they are weaned; but more so in hypochondriacs, if they are too luxurious.

If it proceeds from the remains of the aliment grown sharp, whence flatulencies arise, it generally gives way to tea or coffee alone, or a decoction of camomile flowers, especially mixed with stomachics; likewise preparations of fennel, anise, orange peel, and other carminatives are useful; as also a dram of the powder of orange peel, or camomile-flowers, with a few grains of saffron, in an ounce or two of wine.

When the stomach is too much filled with aliment difficult of digestion, or fat things, a gentle emetic will be necessary, especially if there is a nausea or reaching to vomit; after which, a sufficient quantity of warm water must be drank, to wash the stomach: this will be best promoted with a decoction of carduus benedictus, or half a dram of tartar-vitriolate, salt of worm-wood, and the like; after which stomachics must be given.

In a very violent cardialgia, from congestions of blood, vomits are improper, but bleeding necessary, with antispasmodics of tartar-vitriolate, nitre, cinnabar, crabs eyes, and the like, in a proper vehicle; as also spirit of hartshorn mixt with tincture of tartar to 50 or 60 drops. To these may be added emollient and anodyne clysters, and a bladder of hot milk, with camomile flowers, applied to the pit of the stomach.

#### *Of FLATULENCIES and ERUCTATIONS.*

THE cause of these disorders is generally a weak stomach, and crude flatulent aliment, such as pease, beans, lentils, coleworts, turnips, radishes, hard fat flesh, and the like; which degenerate into wind, creating great anxiety, if not evacuated, and difficulty of breathing. It is a disorder familiar to hypochondriacs, and the stomach being strongly contracted, the wind breaks out with violence.

Another cause of flatulencies are congestions of blood in the branches of the vena portæ; whence proceed anxieties of the præcordia, difficult breathing, colic pains, and the cardialgia, and, by consent of the stomach with the head, pains in the head, the vertigo, and watchfulness.

If it arises from crudities in the stomach, evacuations are necessary first of all; and then strengtheners, aromatics, bitters, and carminatives, such as have been mentioned in the preceding diseases; with a sparing diet and exercise.

If it proceeds from congestions of the blood in the branches of the vena portæ, which is the case of hypochondriacs, or when usual bleedings are suppressed, a vein

must

must be opened; if the body is collicive, an emollient clyster or a gentle laxative will be proper. If these fail, chalybeate medicines must be used, such as the tincture of vitriol of mars, steel-sfilings finely powdered to 6, 8, or 10 grains, or oil of cinnamon with sugar, or bitters, or spaw-waters, with constant exercise.

#### Of WORMS.

WORMS are various with respect to their shape and magnitude, and have their seat in the stomach and intestines. The round are furnished with a proboscis, and a kind of crooked claws, wherewith they sometimes gnaw and tear the membranes. If these lodge in the stomach, their bites are attended with an inexpressible pain, anxiety, inquietude, nausea, and flux of spittle; a fetid smell exhales from the mouth; the countenance is now pale, and then red; there is an itching of the nostrils, with an inclination to vomit, and a dry and troublesome cough by fits, and sometimes fainting.

When they are contained in the intestines, especially the ilion, then they produce the following symptoms. The belly is strangely distended, especially in infants, and they seem to be afflicted with the tympany, with now and then a diarrhoea, and the fæces are of an ash-colour, not unlike cow dung: the upper parts waste away, inasmuch that the bones are visible, and yet the appetite is great. The face is generally pale and tumid; the excrements seem to be full of cucumber-seed, or the like.

The signs of the ascariides are as follows: Their seat is chiefly in the gross intestines, and they are most plentiful in the rectum. They are like book-worms, and are thrown out in large quantities. They have many things in common with the other insects, and produce inflation of the belly, leanness, and a nausea; they are attended with a great itching of the anus, and cause fetid excrements.

The broad worm, called tænia, is like a narrow tape two or three ells long, or longer, divided through the whole length with cross joints or knots. Andry affirms, that there is only one in the body at a time, and therefore is called solium.

The Greeks called the remedies against worms anthelmintics; the most approved of which are asa-fœtida and sagapenum, especially if mixed with purges, such as mercurius dulcis, and extract of rhubarb in pills; with this caution, that before and after the use of them, a few spoonfuls of salad oil, or oil of sweet almonds should be taken, for all things of that kind are of great use. The seeds of cina, fantonicum, and tansley, are likewise useful, by resisting the putredinous colluvies, and restoring the tone of the intestines.

Some affirm, that bitters are good remedies, as the tops of wormwood, the lesser centaury, scordium, and flowers of tansley; likewise Peruvian bark, and eleutheria, in beer or wine, chiefly canary, in which some spoonfuls of the infusion or decoction should be taken every day. Aloes, myrrh, and corallina, are likewise powerful medicines in a proper vehicle, or with honey, in the form of an electuary. The fresh juice of water-cresses, taken every morning for some days, is likewise proper.

The filings of steel disturb the lumbrici and ascariides; as

also Spaw waters; likewise spirit of vitriol or sulphur, and the elixir of vitriol: Wine itself is not a bad thing drack at meals.

Medicines of quicksilver are likewise good, especially half an ounce of it boiled in a pint of wormwood water, in a glass-vessel, for half an hour, stirring the quicksilver with a stick: the dose is a spoonful for a boy, often in a day: an adult may take three, in an ounce or two of solutive syrup of roses; or it may be boiled in milk, if the children prefer it.

If these fail, a purge should be given every third or fourth day: such as mercurius dulcis, with aloes, diagridium, resin of jalap, or troches of alhandal.

When internal things are rejected, the belly may be anointed with oxes gall made hot, two or three times a day, or with oil of coloquintida, or of wormwood, with distilled oils of wormwood and tansley, to which the decoction of quicksilver with milk may be added.

To kill the ascariides, chalybeates are good, and mercurial purges, with clysters of a decoction of wormwood, seeds of cina, myrrh, and quicksilver, to which may be added an ounce and a half or two ounces of oil of wormwood made by decoction. Or the clyster may be of salad oil, or oil of sweet almonds, or linseed alone, and injected often.

The powder of tin has been used many years as a remedy against worms, and particularly the flat kind which often elude the force of other medicines; but the success of this depends upon the proper dose, and then it will have remarkable effects.

Take an ounce and an half of pewter, and grind it to a fine powder, and mix it with half a pint of treacle.

To adults give two ounces of the powder of pure tin, sifted through the finest hair sieve, mixt with eight ounces of treacle, after the patient has been purged with an infusion of senna and manna.

#### Of DIFFICULTY or SUPPRESSION of URINE.

DIFFICULTY of urine arises generally from a stone, or from an inflammation of the kidneys or the neck of the bladder. In sanguine persons, it may proceed from the suppression of some usual hæmorrhage, or from the blind piles; or there may be a congestion of blood in the spongy or cavernous part of the urethra, which may be so distended and inflated, as not to transmit the urine, or at least with great difficulty. In some it may be owing to a spasm of the neck of the bladder, or to sharp urine; in others to a palsy of the bladder, or a caruncle of the urethra; or from a tumour, abscess, or ulcer, in the prostrate gland; or from its being too large, or indurated, as often happens. Likewise in bloody urine it is not seldom suppressed; at least it is expelled with great pain and trouble, which proceeds from a concretion of blood. Etmuller affirms, that a dysury is generally occasioned from the want of mucus of the urinary passage, or its being worn off.

As the causes of an ischury are various, they ought to be carefully distinguished from each other. When it proceeds from an inflammation of the kidneys, the pain and heat are principally in that region, attended with a fever; if from a stone in the kidneys, it is accompanied with vomiting; if from a stone in the bladder, there is a violent  
pain

pain in the bladder, which is extended to the very extremity of the urethra; a mucus or pus is excreted with pale urine; and, upon proper examination, the stone may be felt; but the most certain sign is searching the bladder with a catheter. When this disorder arises from a stone in the urethra, it may be easily felt. If from an inflammation of the neck of the bladder, there is a tumour and pain in the perinæum: but it may be best perceived by thrusting the finger into the anus, and turning it up towards the bladder; for a tumour will be perceived by the physician, and by the patient a burning and pressing pain; and when a catheter is introduced into the urethra, an impediment will be felt near the neck of the bladder, which will hinder it from proceeding further. To these signs may be added, when the disorder is great, a tenesmus, a constriction of the anus, an anxiety of the præcordia, coldness of the extreme parts, vomiting, and a frebible pulse. When the cavernous substance of the urethra is too much distended with blood, and the urine is suppressed, a silver pipe cannot be admitted into the urethra, especially if the patient abounds with blood. When there is a spasm in the neck of the bladder, it appears from the causes aforesaid; and likewise the patient perceives a spasmodic constriction about the neck of the bladder, and a catheter will pass thereto, but no farther; and there are no signs of a stone in the urethra or bladder.

If the urine is sharp, and produces a spasm, we may discover it from its being very stinking, especially if the patient is old or scorbutic; and there are many saline particles in the urine like lime. When there is a caruncle in the neck of the bladder, it may be known from the signs mentioned in the lues venerea, where the cure is treated of. An abscess in the prostate gland often is mistaken for a caruncle. When a scirrhus of the prostate gland is the cause of a suppression, there is a hard or indolent tumour in the perinæum, or at least the pain is not great.

When the urinary passages are obstructed by solid bodies, that is, the pelvis of the kidneys, the ureters, or the neck of the bladder, or the urethra, from a stone contained therein; if it be small, diuretics will be proper, which are mentioned in a fit of the gravel or stone; to which may be added a decoction of eringo-root and Epsom salt or Selters waters taken often therewith. But if the stone is large, and cannot be excreted by this means, strong diuretics are highly hurtful, and it must be cured by section; (see SURGERY.) But if the patient is too weak, or too old, and cannot undergo the operation, the stone, if possible, must be driven back; and the pains must be appeased with antispasmodics internally, and with lenients, lubricant and oily medicines, as well as gentle anodynes: Externally, with emollient clysters, ointments, liniments, and baths. If the pains are violent, lenient injections may be thrown up into the bladder, of salad, linseed, and white poppy oil, or oil of sweet almonds, or a decoction of linseed or roots of mallows in milk, with the addition of a little fresh butter. This done, the patient must have recourse to lime-water.

If the urine is suppressed from an inflammation of the kidneys or bladder, diuretics are pernicious, and mineral waters not safe; but rather refrigerating nitrous remedies,

neutral salts, crabs-eyes, tartar-vitriolate, may be given, with a grain of camphor in every dose. To render them more efficacious, they may be joined to a decoction or infusion of parsley roots, eringo-tea, ground-ivy, or the like; likewise emulsions of the four colds seeds, with crabs-eyes, calx of antimony, and nitre, or seeds of violets, which are laxative and gently diuretic: to these may be added fomentations, and a bladder filled with hot milk or water, or emollient and resolvent cataplasms, applied to the region of the kidneys or bladder, or perinæum, according to the place of the inflammation, as well as baths of the same kind; but above all, bleeding is necessary, especially in the plethoric, and the promoting of usual hæmorrhages. In the mean while aperients and resolvents must be given, such as powders of crabs-eyes, arcanum duplicatum, tartar-vitriolate, and nitre; or medicinal waters, with bitter cathartic salts given now and then.

When the spongy substance of the urethra is swelled with blood, and as it were inflated, a copious bleeding is the principal remedy.

When a spasm affects the neck of the bladder, it must be treated with temperating and antispasmodic powders, diuretic waters, and infusions, with emulsions, or lenient oils now and then, such as salad-oil, oils of sweet almonds, poppy or linseed: externally, cataplasms, ointments, clysters, and baths, of the emollient and demulcent kind; with gentle opiates, if the disease requires them.

If the spasm proceeds from a sharp urine, from the surry, or otherwise, it must be treated with gentle purges and diaphoretics, and absorbents, such as crabs-eyes, mother of pearl, prepared chalk, calx of antimony, and amber; with lenient decoctions of china root, sarsaparilla, or mallows, with emulsions and demulcent oils; to which may be added syrup of marsh-mallows; when the pains are violent, they must be appeased with moderate opiates.

If the difficulty proceeds from blood remaining in the bladder, or its neck, the concretion is to be resolved and expelled with warm infusions of digestive herbs drank like tea, such as ground-ivy, arnica, chervil, or veronica; with tincture of tartar, or liquor of the terra foliata of tartar, with digestive powders of crabs eyes, saturated with the juice of oranges or lemons, sperma ceti, tartar-vitriolate, nitre, and cinnabar: to which may be added the water of chervil or parsley; with roasted onions applied hot to the region of the pubes, perinæum; or cataplasms of wheat-flour boiled in milk, with butter and a little saffron, or with white lily roots, mallows, marsh-mallows, or camomile flowers applied to relax the spasm of the neck of the bladder; or with a bladder of hot milk, in which camomile flowers have been boiled; with emollient and resolvent clysters of camomile-flowers boiled in milk, with oil or fresh butter: but, if all these fail, a catheter is to be introduced into the neck of the bladder, to break the concretion, and evacuate the urine.

When there is an ulcer in the bladder, which will appear from purulent and fetid urine, with a most violent pain in the bladder, as if a stone was contained therein; all sharp and stimulating things must be avoided, and the infusions of vulnerary absorbent roots and herbs must be given with mucilages and soft balsamics, especially balsam of Mecca, Tolu, &c. with a moderate use of quicksilver,

especially if the case is venereal. Then mineral waters may be drank, either alone or with warm milk, for several weeks, or the hot bath waters: to these may be added injections of a decoction of the traumatic herbs, such as agrimony, St John's wort, plantain, or yarrow; or, in their stead, milk with syrup of marsh-mallows, or fresh butter, or oil of St John's wort.

If there is a difficulty of urine in pregnant women towards the last months, diuretics must be shunned. The best remedy in this case is to ease the pressure upon the part; but, if that will not do, to use a catheter.

Lastly, if it proceeds from a swelling of the prostate gland, or if it is become scirrhus, it must be treated as such, as will be hereafter taught.

But, if these remedies will not do, the bladder must be pierced with a trochar, which is called the puncture of the perinæum; and, when the perforation is made, the water must be evacuated, as in the dropsy: The instrument must be left in the wound, and be fastened in such a manner that it does not fall out, that so the urine may be made as often as there is occasion: It is a troublesome operation, but the only one left.

#### *Of the DIABETES.*

A DIABETES happens when the urine comes away crude, exceeding the quantity of liquids drank, attended with weakness, which generally proceeds from the kidneys, which are too weak and lax, especially in those who have been accustomed to drink too much. HEIST.

Lifter observes, that a diabetes comes slowly on, and is a long while in breeding. In the beginning, the mouth is dry, and the spittle a little white and frothy; the urine being somewhat more than usual, with a small thirst. A heat begins to be perceived in the bowels, which is a little pungent; the patient falls away, and the mind is anxious and unstable. In time the thirst greatly increases, the urine is plentiful, and the body wastes. When they make water without intermission, the thirst becomes intolerable; and, though much is drank, it is not proportionable to the water. When the urine is retained a little while, there is a swelling of the loins, ilia, and testes, and it comes away with pain. Now death is at hand. The urine is pale, not sweet, but it is more sweetish at last than at first.

Strengtheners, moderate astringents, and species of hyacinth, with crocus martis, are good in this disease, especially with anodynes: or Japan earth, or the tincture of vitriol of mars, red wine with water in a small quantity: the drink should be sparing, and all excesses avoided. Exercise and frictions of the body are likewise profitable, because they strengthen the parts, and increase perspiration.

Lifter says, almonds and a milk diet are proper in this distemper; as also wine with ginger; allowing in the mean time a draught of milk and water to allay the thirst.

Willis declares, he has often prescribed tincture of antimony with good success; and lime-water with saffras, aniseeds, raisins, or liquorice.

## OF WOMENS DISEASES.

### *Of the CHLOROSIS, or Green-Sickness.*

SYDENHAM looks upon this to be a species of the hysterical affection, and is known by a paleness and discoloration of the face and the whole body. The complexion appears a little sallow or greenish, with a red or dark circle under the eyes; the face is bloated, the eyelids and angles are apt to swell; the whole body is heavy and dull; there is a tensive lassitude of the legs and feet, difficulty of breathing, palpitation of the heart, pain of the head, a feverish pulse, a drowsiness; a pica, or desire of eating unfit things, such as coals, chalk, &c. and a suppression of the menses. The clavus hystericus often attacks patients in the height of this disorder.

The cure is to be attempted with chalybeate medicines, such as are prescribed in the hysterical disorder, given according to the patient's age, drinking wine after them; or the corroborating infusion with angelica root. If the patient is not very weak, she may be purged once or twice before the course is entered upon.

Heister recommends attenuants, evacuants, and strengtheners, with a good diet and exercise; particularly from v to viij grains of powder of steel, with half a scruple of a proper extract of saccharum, or with bitter extracts given in the evening; as also emmenagogues at due times, with pediluvia and bleeding in the foot about the time of menstruation. If these will not suffice, he thinks matrimony a certain cure.

### *Of the SUPPRESSION of the MENSES.*

As soon as a healthy female arrives at her full growth, she generates more blood than can be conveniently contained in the vessels; wherefore the superfluity is evacuated by the uterine arteries, and is called the *Menses*.

Boerhaave observes, that in a suppression of the menses there is a plethora, with a listlessness to motion; a heaviness, a paleness, a pain of the loins and of the groin; all the functions, whether natural, vital, or animal, are depraved. Sometimes the menses will force a way thro' the eyes, ears, nostrils, gums, the salivary ducts, bladder, breasts, skin, wounds, or ulcers.

Hence often arises a deprivation of all the viscera, as also diseases without number, partly from a putrefaction already begun, and partly from the hurt which the vessels have received.

From this disorder proceed want of appetite; the pica and malacia, or a depraved appetite. If it is habitual and obstinate, a scirrhus or dropsy of the womb are to be feared, or a rupture of some blood-vessel, especially of the lungs. It is not so dangerous when the uterus is not infarcted, or when there is no other symptom of the menses. If this disease is attended with the fluor albus, it may become habitual, and from yellow become green and acrid, corroding the uterus, and laying a foundation of a dropsy therein.

Things which retard the menses are, immoderate cold, sorrow, a sudden fright, too great evacuations, increas-

ting

ting diet, a crudity of the humours, acids, and astringent medicines.

This disorder is to be cured in the same manner as the hysterical affection; but, if the remedies for that fail, the patient must take every morning five spoonfuls of an hysterical julep, with twelve drops of spirit of hartshorn; and every night a scruple of compound powder of myrrh made into a bolus, or pills with syrup of lemons. Allen recommends cantharides and camphor; the dose is from two grains to six.

Hoffman directs chalybeates, or pills made of aloes, myrrh, saffron, amber, castor, and round birthwort. Pitcairn thinks mercury more efficacious than steel.

If the fluids are inclinable to stagnate, their fluidity may be preserved by fomentations and frictions of the feet; by opening a vein in the foot, and bleeding elsewhere; by giving uterine purges; by emmenagogues; by plasters, fomentations, liniments, vapours and heat; by strengthening the vessels debilitated with a plethora, by chalybeates and astringents.

Uterine cathartics are aloes, myrrh, bryony, colocynthus, gum-ammoniac, bdellium, sagapenum, opopanax, asa-fetida, galbanum, and elixir proprietatis.

Emmenagogues, besides the former, are, aristolochia, mugwort, motherwort, camomile, juniper, marjoram, marum, feverfew, pennyroyal, rue, savine, sage, elder, wild-thyme, tansy, thyme. To which may be added balm, rosemary, wall-flowers, saffron, bay and juniper berries, amber, rhubarb, and aromatics. As also borax, alkaline and volatile salts; warm, stimulating, acrid, and aromatic oils; the barks of guaiacum, sassafras, cinnamon, and juniper; the rinds of oranges, citrons, and lemons.

Resolving plasters are those of cummin, melilot, galbanum, bayberries, labdanum, oxycroceum, which must be applied to the soles of the feet, navel and groin. The fomentations may be made of Venice soap, and some of the above mentioned herbs.

*Of the IMMEDIATE FLUX of the MENSES, or  
Uterine Hæmorrhage.*

EVERY large flux of blood from the uterus is not to be esteemed noxious, but such only as is attended with loss of strength, which brings on other symptoms, such as want of appetite, crudities from indigestion, a sensation of weight near the regimen of the stomach, an ill colour in the face, a languid pulse, often with a gentle heat, an œdematous swelling of the feet, and a disturbed sleep without refreshment.

Sometimes the menses flow in too great plenty and with impetuosity at the usual period; sometimes twice or oftener in a month; sometimes again they continue several days longer than ordinary.

This flux sometimes consists of thin florid blood, which happens chiefly in abortions; and from a retention of pieces of the secundines, which keep the mouths of the vessels open. Sometimes there are coagulated and clotted masses like flesh come away with the blood, of the size of an egg, which is occasioned by a stoppage of the menses for two or three months. At other times the blood is grumous, coagulated, and black; generally on the first

days of child-bed, in slender and plethoric subjects. When the patient is cachectic, and the flux continues long, it is thin, watery, and mucid. In the scorbutic, it is corrupt and fetid, with acrimony and pain. In the younger sort, before child-bearing, if the evacuation be immoderate, it is commonly followed by a fluor albus, or the dripping of a white, impure, mucid matter.

The cause may be referred to a copious and impetuous afflux of blood to the uterus, and an unequal and impeded reflux by the veins; which distending and relaxing the uterine vessels, make the orifices too wide, or rend and corrode them, by which the blood flows too freely. This may happen from a plethora, or when there has been a long suppression, or an abortion, or a difficult labour. It generally happens to women about the fiftieth year, when the menses are going to leave them; and not always without danger. It sometimes happens to women upwards of sixty, which, if attended with a slow fever, hastens death.

The concomitant signs are generally these: A tension and inflation of the hypochondria, a heavy pressing pain about the loins, sometimes with a chillness; a coldness of the extremities, a sinking of the vessels, a paleness of the face, a quick pulse, with an internal heat, a costiveness, and little urine; all which shew there is not only a debility and laxity of the uterus, but spasmodic strictures of the vascular and nervous parts, which force the blood to the uterus.

If the body is cacochymic or scorbutic, or full of bad humours, or afflicted with the venereal disease; when the viscera are unsoft, and the liver, spleen, and meseraic veins, are stuffed with thick blood, the case is dangerous and troublesome; for the fault of the fluids and cachexy continually increase: Besides, the more the strength is weakened, the more the stomach and digestion are hurt; the blood is depraved, and the excretions disturbed and lessened. When this happens to women when the child is dead, their lives are in great danger, and nothing but speedy assistance from a man-midwife can save them. The case is also dangerous when the secundines are violently extracted, or parts of them are retained, and which sometimes degenerates into moles.

Immoderate evacuations are produced by a sedentary life, which gives room for abundance of thick chyle and milk. It is caused likewise by too frequent use of salt, acrid, and seasoned meats; by spiritous liquors, &c. by violent agitations and passions of the mind, from losses, gaming, love, anger, &c. It may be observed likewise, that violent exercise does as much harm as the moderate is serviceable, especially if the patient is subject to this flux from other causes; such as immoderate repetitions of the venereal act, especially in women of a delicate constitution; too frequent child-bearing.

The cure should respect the restraining a present flux, and the keeping within bounds a future one.

It should be begun with rest, if convenient, in bed; the patient lying on her back, and silent as much as possible. Bleed in the arm, according as the constitution and strength of the patient, as well as the urgency of the symptoms, will admit or require. Avoid ligatures of the limbs. Let the patient fare slenderly on veal and chicken-broths,

broths, fish soups; and drink a ptisan of nettle-tops, yarrow, and plantane, with orange-peel, or of the greater comfrey; if she be hot and bilious, with linseed.

If these fail, have recourse to astringents.

*Of the FLUOR ALBUS, or Whites.*

THE fluor albus consists in the efflux of a whitish, lymphatic, serous, or aqueous humour, from the matrix.

It is sometimes white, sometimes pale, yellow, green, or blackish; sometimes it is sharp and corrosive, sometimes foul and fetid: the face is discoloured, there is a pain in the spine of the back, the appetite is lost, and the eyes and feet swell. Some women have a periodical flux of the whites instead of the menses.

The symptoms are, a pain and weight in the loins, which is worst in the lymphatic flux, as being attended with a swelling of the uterus, turbid urine, barrenness, a proneness to abortion; a loathing of some things, and longing for others; indigestion; thickness and crudity of the blood; whence proceed œdematous swellings of the feet by day, and of the face by night; difficult breathing, palpitation of the heart, syncope, relaxation of the ligaments of the uterus, a total or partial proclivitas uteri: if the flux is acrid and corrosive, it ulcerates the vulva; creates phlyctenæ; which last generally proceed from a scirrhus or cancer in the uterus; a slow fever; dropsies of different parts; of which, or a consumption, the patient generally dies.

It may be known from a virulent gonorrhœa; because this is attended with pain and an inflammation of the external parts of the pudenda, chiefly about the clitoris; heat, sharpness and difficulty of urine, pain in coition; it makes its progress sooner. If the gonorrhœa is inveterate, it is very like a fluor albus.

Besides arterial blood, the menses consist of redundant lymph or serum, chiefly from the membranous cells, and ventricles of the glands of those parts of the membrana cellulosa which are more immediately connected with the kidneys, uterus, and ovarium. When this lymphatic secretion becomes morbid, it is called the fluor albus. At first the parts of the membrana adiposa of the loins, kidneys, and uterine appendages, are wasted by it; but at length the flux becomes acrimonious, and may melt and carry off all the fat of the body.

The fluor albus sometimes is discharged from the uterine vessels, and sometimes from the glands of the vagina: in the first case it stops when the menses begin to flow; in the latter it continues with them, and pregnant women are not exempted from it.

When this flux is unseasonably stopped, it causes the belly to swell, with pains of the loins, slow fevers, numbness of the joints, and great lassitude of the body.

When the flux is lacteous, it may be cured in fifteen days. The patient must feed sparingly, use frequent exercise, and sleep little. If this is not complied with, she must bleed in the arm once or twice a-month, and take purges and emetics, or at least frequent clysters. The efficacy must be assisted with diaphoretics, decoction of the woods, and diuretics.

In the semilacteous flux, inspissating and nourishing diet will be best, such as creams, soaps, boiled milk,

roast meat, jellies, &c. milk, or milk turned with a decoction of china, is very good.

Narcotics are highly useful, especially if the patient is restless, or delirious. In the beginning the dose must be small, which may be gradually increased.

When the vesiculæ lacteæ are relaxed, the tone must be restored with hot mineral baths, fomentations and injections of and bathing in the same. The stream may also be conveyed into the vagina with a funnel.

Decoctions of the woods are also good as diaphoretics; and diuretics of a decoction of roots of eringo and rest-harrow, with powder of millepedes, or glauber's salt.

If the lymphatic flux is attended with a scrophulous, scorbutic, or venereal taint, these disorders must be first removed. If the uterine lymphatics are compressed by scirrhusities, cancers, gangliens, or the like, regard must be had to the causes.

In obstructions of the glands of the uterus, begin with bleeding; then a gentle purge, or an emetic of iij grains of tartar emetic or ipecacuanha. Afterwards, if the patient's constitution is cold, attenuating aperients. If she is hot and bilious, with a sensible pain in the uterus, cooling broths and apozems, with the addition of crayfish; asses milk, with a decoction of barley; chalybeate whey, with chervil boiled therein. Gently purging mineral waters, baths, and half baths, are convenient in the summer.

*Of the FUROR UTERINUS.*

SALACITY in women, attended with impudence, restlessness, and a delirium, is called the *furor uterinus*.

It arises from a too great sensibility or inflammation of the pudenda, or parts wherein the venereal stimulus resides, which are chiefly the clitoris and vagina; or the too great abundance and acrimony of the fluids of those parts; or both these causes may exist together.

In the delirium maniacum, the patient is entirely shameless; in the melancholicum more reserved, and her folly is confined to fewer objects.

It may proceed from the abuse of hot aperitives; thus sal amoniac, borax, and cantharides, have produced it; from powerful emenagogues in hot and bilious constitutions; sometimes from difficult and suppressed menses; from remedies given against sterility. Musk dissolved in oleum aromaticum, and rubbed on the membrum virile, has raised a phlogosis in the vagina, whence a furor uterinus ensued.

It is difficult to cure in those whose menses are difficult at first; in inveterate cases; in old subjects. It is easier cured, when the furor uterinus is essential, and the delirium symptomatic, than when the delirium is essential, and the furor symptomatic. The maniacal delirium is harder to manage than the melancholic. If it continues a month or two, the fault of the brain becomes obstinate, for it degenerates into real madness.

The indications of cure, are to diminish the heat and sensibility of the affected parts; to cool, sweeten, and dilute the blood, and to render it balsamic; or to pursue both intentions at once.

The first indication is answered by frequent and copious bleedings, as in an incipient madness; even to eight times in

in two days, if nothing forbids; if she faints, there is no danger. She must likewise be purged, as mad folks are, with jalap, scammony, diagrid. The dose must be increased one third, as being hard to purge. Emetics are also good; for they evacuate the bile, which abates the acrimony of the humours. In the intervals, order frequent emollient clysters: to which add half a dram of sal prunella, or a little vinegar morning and night, baths and fomentations; moderate the heat, irritation, and sensibility of the parts affected: as also emollient injections into the vagina, and fomentations, or pessaries of cotton may be steeped therein; sal prunella may also be mixed therein.

*Of an INFLAMMATION of the WOMB.*

AN inflammation of the uterus appears from extraordinary heat, and a fixed pain in the groin, with an acute fever, a pain in the loins and belly, an inflation of the abdomen, a stimulus to make water and go to stool; heat, and difficulty of urine; tumour, pain, heat, and tension of the hypogastric region; redness of the os uteri, and great heat of the vagina. If the fore-part of the uterus is affected, there is a dysury or heat of urine; if the back part, a tenesmus, frequent faintings and cardialgia, a burning fever; or, if the inflammation is violent, a pyrryia, in which the external parts or extremities are cold, and the internal burn, and the pulse is imperceptible; a delirium and phrensy: the breasts swell in proportion as the inflamed uterus.

This disease may be said to be superficial or more grievous and profound. It is easily formed in child-bed women, and frequently accompanies the milk fever; and may be cured in a few days, if rightly managed: But when it is very intense, and attended with grievous symptoms without remission, it kills on the seventh, ninth, or eleventh day; and a white miliary fever generally supervenes, which is the worst omen, for it shews a mortification of the uterus. When this fever happens, there are spastic and painful strictures in the abdomen, the flux of the uterus is stopped, the body is colicive, the feet are cold; there is an urging to make water, which is painful; the head looks red, and swells; the eyes shine; drops of blood fall from the nose; the mind is disturbed; the sleep is little, with terrifying dreams: there is likewise most difficult breathing, faintings, convulsions, a phrenetic delirium, which commonly have a fatal tendency.

This disease should be distinguished from an inflammation of the bladder or rectum; which may be done from the place of the pain: in that of the bladder it is superficial, as if it were in the integuments; in that of the rectum it is very deep, as if about the os sacrum; in that of the uterus it is in the middle, with a violent heat in the vagina, if the finger is introduced. If the bladder is affected, there is an extraordinary heat and retention of urine; and a tenesmus, if in the rectum: In the bladder; the pain is precisely on the os pubis; in the rectum, the anus is affected. If these symptoms happen in an inflammation of the uterus, they are more slight.

If the inflammation is not resolved, it generally ends in a mortification, ulcer, or cancer. A mortification soon

kills, and the womb and vagina after a dissection appear to be of a blackish brown. If it ends in a suppuration, the disease is of longer date, which generally happens to women not in child bed: It begins to discover itself about the ninth or tenth day, by the cessation of most of the inflammatory symptoms, which will return about the twelfth with a shooting pain in the affected part.

A gangrene or mortification happens on the fourth or fifth day, and is known by a weak, languishing, and intermitting pulse, and by a sudden cessation of all the symptoms.

If the disease exceeds the time of the former terminations, and the inflammation is superficial, it is apt to turn to an induration or scirrhus; which ulcerating, becomes a cancer, and is incurable. If, about the twenty second day, there is a renitency or hardness, and a dull heavy pain in the region of the uterus, there is a scirrhus formed.

Women in child-bed sometimes have the womb inflamed from the fault of unskilful midwives, or hard labour; or the lochia are stopped by pains, or hysterical spasms, dread, or cold; wherefore proper precautions should be used to prevent it; which may be done by keeping them under a gentle diaphoretic regimen, and by allaying the almost febrile heat. Oil of almonds is proper alone, or with a fourth part of sperma ceti, given daily to half an ounce in chicken-broth; externally the whole abdomen should be anointed with oil of dill, camomile and white-lilies, of each an ounce, oil of caraways a dram, or a dram of camphor; laying a warm napkin doubled over the same.

The tumult being thus appeased, the lochia are to be promoted with pills of bitter extracts, temperate resinous gums, and aloes well corrected, of which xv gr. is a dose morning and evening, to be continued from five to eight days. These are also good when the after-birth or part of it is retained.

If there is a fever, the belly is distended with wind, the lochia are retained, and the spasms tend to the upper parts, you must bleed in the foot.

The drink may be chicken-broth, with scorzonera-root, succory, and shavings of hartshorn boiled therein. As also temperating and resolving powders made of crabs-eyes, and their solution nitre, and sal polychrest. To which may be added clysters of whey, camomile-flowers, mug-wort, sage, &c. with honey, nitre, and fat of hens.

In women out of child-bed the inflammation generally happens in the neck of the uterus and the vagina; and then, besides the foregoing things, you must apply epithems to the pubes, uterine injections, pessaries, and suppositories. The epithem may be of argemone water four ounces, essence of saffron, camphorated spirit of wine, of each two ounces, nitre a dram, dissolved in elder-flower water; and, as circumstances require, mixed with vinegar, or rue, or scordium, and applied with a double cloth. The injection may consist of asses milk, with flowers of elder, myrrh, and saffron; and a little nitre may be added to the decoction. The tenesmus may be appeased with emollient half baths, or with an ounce of oil of sweet almonds, and xij grains of saffron, injected into the anus. These remedies are useful in case of a suppuration.

*Of the ABSCESS of the WOMB.*

ABSCESSSES of the womb are either inflammatory, tuberculous, or steatomatous.

The symptoms of an incipient abscess are much the same as the inflammation, such as pain, heat, tension, &c. which intermit for some time, and appear again, when the suppuration begins; of which the inflammatory is most sensible, the steatomatous the least. When the abscess is formed, all the symptoms of inflammation vanish: but coldness of the extremities, a slow fever, and marasmus, gradually increase from the absorption of the pus into the blood.

If no inflammation has preceded, and the patient was subject to obstructions, especially of the glands of the uterus, and had a lymphatic fluor albus, it may be tuberculous; if the tumour is soft and indolent, it may be steatomatous; but these are rare. The place may be partly discovered by the touch, but more especially by the complaints of the patient.

If it breaks into the bladder, and passes off by urine, or into the rectum, and is discharged by stool, or into the groin, it is dangerous; if into the abdomen, incurable: if it breaks into the vagina, it may become an ulcer, which is commonly mortal; or the patient may perish by a hectic fever before the eruption. The tuberculous and steatomatous are much the slowest.

The work in this case must be left to nature, in a confirmed abscess; unless it can be come at through the vagina, and opened with a lancet, and then detersive injections may perform a cure.

*Of the ULCER of the UTERUS.*

AN ulcer may have its issue and seat in the concave surface of the uterus; or may be lodged more deep, and have issues into the rectum, bladder, groin, or cavity of the abdomen.

The causes of an erosion may be the fluor albus, or rather lymphaticus; the corruption of the fetus, or placenta, in the womb; acrid or caustic injections; the frequent use of cantharides, the lues venerea, or acrimonious menses.

If the ulcer proceeds from an abscess, it may be inflammatory, tuberculous, or steatomatous; if from an erosion, it may be venereal, scorbutic, scrophulous, or simple: It may be also simple, scirrhus, or cancerous.

The chief sign of an ulcer is the efflux of purulent matter; and the greater the quantity, the profounder the ulcer. If the flux is sanious, or mixed with blood, the blood-vessels are eroded. Mortal hæmorrhages sometimes supervene. Sometimes they may proceed from a fever, and rarefaction of the blood.

An ulcer is hard to be distinguished from a fluor albus: however pus is always more compact and fetid, unless it is lymphatic; and there is always a fixed pain from an ulcer.

All ulcers of the uterus are dangerous; when they are fistulous, or scirrhus, or both, they portend death: the same may be said of the cancerous; or when they are attended with a slow hectic fever, swellings of the feet, a marasmus, &c.

In order to the cure, it is necessary to know whether the ulcer is seated in the body of the uterus, or near the os uteri, in the vagina; or whether it be venereal, for the last must be treated as that distemper requires.

To correct the vicious acrimony of the blood, use broths, or decoctions of lettuce, fucory, borrage, with sal prunella; sometimes with veal or a pullet; also chalybeated whey, sweetened with syrup of violets. But the best thing is a milk-diet; to which, for variety sake, may be added rice, eggs, a decoction of china, barley, &c. or chervil, agrimony, fumitory, or the second lime water, or steel-waters alone. Likewise emollient baths or fémicupia.

Injections of whey and brown sugar are good.

To consolidate the ulcer, use injections of agrimony, with the second lime water; or warm sulphureous bath-waters, and the fumigations of the gums.

To ease the pain, give gentle narcotics.

*Of the SCIRRHUS of the UTERUS.*

SOMETIMES an inflammation of the uterus ends in a scirrhus, which is a hard, renitent, and indolent tumour, without heat and pain.

It is a very troublesome disorder, and often incurable, and the attempt to remove it is dangerous, though it is apt to bring on dropsies, a cancer, a marasmus, &c. Its seat is in the glands, lymphatic vessels, or lacteals of the uterus.

The symptoms are, a weight in the hypogastrium, when the patient stands or walks; difficulty of lying on the well side; if the tumour is painful, she is obliged to lie on her back; the menses are suppressed; sometimes there are violent and dangerous hæmorrhages; a dropsy of the abdomen or uterus: If it suppurates, there are signs of an abscess. It may be partly discovered, by pressing the hand on the region of the os pubis.

If the tumour be small, recent, and void of pain, you may give broths of eringo, rest-harrow, and asparagus roots, of each half an ounce. Whey, with vitriolate tartar, or chalybeated whey, are very gentle. Or give a pint every day of vitriolic waters, for two or three months.

If these heat too much, she must drink asses or goats milk. This is a palliative cure. But, to dissolve the scirrhus matter, the patient must use baths, and half baths, of emollient decoctions. Emollient injections and moderate clysters are very beneficial.

When heat, pain, and tension of the uterus are perceived, forbear deobstruents, and bleed. Use no aperitives at the time of purging. At other times use diluents and narcotics. If the tumour does not diminish, leave these medicines off, and have recourse to the palliative cure.

*Of the CANCER of the UTERUS.*

A CANCER is a scirrhus become exquisitely painful. When there is a darting or lancinating pain in the scirrhus, and in fifteen days or a month it becomes much larger than it was before, and scabrous that is, angular and rugged; and the skin that covers it is smoother, till a fissure appears; the lips of which are retorted, and an ichor or acrimonious serosity proceeds therefrom,

with

with a soft fungous flesh about the fissure; you have the progress to a confirmed cancer. The matter never becomes pus.

An ulcer of the uterus resembles a cancer, when a putrid sanies issues from the corrupted substance of the womb, with great stench, exquisite pain, and grievous symptoms. This disease is almost incurable.

The principal symptom of a cancer is pain, which is attended with restlessness, watching, indigestion: which produce a slow fever, consumption, marasmus, and the like.

A hard, renitent, painful tumour, preceded by an indolent scirrhus, plainly evinces the existence of a cancer. If nothing is discharged by the uterus, but a limpid, pellucid lymph, it is an occult cancer; if acrid serum, or ichor, it is open.

There is nothing to be done in this case, but by demulcents and lenients. If there is any hope of cure, it must be placed in asses milk, the Selters waters, and in bathing in soft water wherein wheat-bran has been boiled; in which the patient must sit for an hour, or longer. She must abstain from all sharp, acrid, stimulating, and heating things.

#### *Of the PROCIDENTIA UTERI.*

IT is a common disorder; and the uterus presents itself in the vagina between the labia, or is quite visible. Sometimes it is only the internal membrane of the vagina, some times the body of the womb.

This disorder is rarely dangerous, for women bear it a long time.

The cure consists in reducing the uterus, and retaining it in its place. To reduce it, order a simple clyster to evacuate the rectum; the patient should also bleed three or four times: Then emollient cataplasms should be used of white bread and milk, or of emollient plants; emollient baths are also to be employed. The parts being thus relaxed, the patient must lie on her back, with her hips higher than her head, and her legs quite asunder; then put back the uterus by degrees, where you find the least resistance, and without any violence. This done, the patient must be confined to her bed for about fifteen days, with her thighs closed, or her legs across, and her hips raised.

The cure must be completed with astringent injections, baths, and pessaries; with fumigations of frankincense, red roses, and mastic.

For ABORTIONS, }  
For CHILD-BIRTH, } see MIDWIFERY.

#### OF CHILDRENS DISEASES.

##### *Of Disorders from a Retention of the Meconium.*

INFANTS newly born, from a retention of the meconium and other sordid matter in the *prima via*, are subject to gripings or pains in the belly, which produce constant crying, hiccups, the jaundice, wakefulness, restlessness, startings, frights, convulsions, and epilepsies; which, unless timely prevented, are fatal.

To carry this off, infants should suck the first milk of their mother, if they give suck; otherwise they should

fast ten or twelve hours; or take the following mixture, which will soften it:

Take 6 drams of fresh milk whey, and one dram of honey; make them into a draught.

Heister advises a grain or two of the powder of jalap, or two or three of rhubarb in syrup of roses solutive, or a solution of manna; some give half an ounce of oil of sweet almonds, with a little barley-sugar. A grain of aurum fulminans is the surest remedy.

##### *Of Disorders from Costiveness and Wind.*

If after some time the excrements become hard, with costiveness and a retention of wind, they will cause the symptoms abovementioned. In this the same remedies may be used, till the child's belly is open, and the acid or corrupted milk should be corrected with absorbent and testaceous powders; whereof half a scruple is a dose. Harris believes an acid to be so predominant in infants, as to cause all their diseases. Boerhaave affirms, if absorbents are useful at any time, they must be in these cases, and orders *vij* grains of the testaceous powders three times a day.

The nurse must forbear to feed upon any thing that is four or acid.

##### *Of WATCHING, or Want of Sleep.*

WANT of sleep proceeds from the gripes, or costiveness, and wind and pain occasioned thereby: we judge of the health of children by their sleeping quietly, and of their illness by their watching, crying, and screaming. Watching may proceed from the milk being corrupted in the stomach, or from costiveness, or from wind.

In this disorder the body should be always kept open, first by a clyster, and then a purge; and the absorbents are to be given, and carminatives, particularly powder of aniseed; and the belly is to be anointed with carminative oil. Soon after the purge, give two drams of oil of almonds. The nurses should avoid acid and flatulent things, and catching cold. Opiates, diascordium, and theriaca, must never be used, unless in cases of extreme necessity.

##### *Of the APHTHÆ, or Thrush.*

THE apthæ are little whitish ulcers affecting the whole superficies of the mouth, that is, the lips, gums, checks, tongue, palate, and fauces; nay, they even descend through the œsophagus to the stomach and intestines, and to the anus; but then they are very dangerous, and commonly put a period to the infant's life.

Boerhaave says, if the apthæ are of a pearl-colour, pellucid, white, few in number, superficial, soft, and fall off easily, apt to return in part, they are of the best sort; but if they are white or opaque, like bacon, yellow, brown, black, thick, dense, running together, hard, tenacious, constantly restored, corrosive, they are bad.

Harris believes gargles to be of little service, because infants cannot use them, inasmuch as they swallow every thing that is put into their mouths. He therefore relies for a cure on the testaceous powders, and the most gentle cathartics, and believes them sufficient.

Allen says the decoction of elm-bark is the best gargism for the cure of the apthæ.

This

This disease often attacks ADULTS in acute diseases and inflammation of the viscera. Boerhaave observes they are most common among the northern people, that inhabit low marshy places, and often attend a continual putrid fever, or an intermittent becoming continual; and that they are ushered in with a diarrhoea, or a dysentery, a nausea, vomiting, loss of appetite, great anxiety about the præcordia often returning, some great evacuation of the fluids, a stupor and dulness, sleepiness, a perpetual complaint of weight about the stomach.

To cure this distemper, hot, diluting, resolvent, and detergent medicines must be given, that the crust may be disposed to fall off easily.

Huxham advises, when the aphthæ supervene in fevers, to use gargles frequently of emollients and detergents, made with figs, hydromel, decoction of turnips, &c. To give rhubarb inwardly, chiefly if the patient is griped and loose, adding an aromatic astringent with absorbents.

#### *Of GALLING and EXCORIATION.*

THERE is often an excoriation of the parts near the pudenda, chiefly of the groin and scrotum; in the wrinkles of the neck, under the arms, and in other places, proceeding from the acrimony of the urine and sweat. From this proceed itching pains, crying, watching, and restlessness.

To remedy this, the parts affected may be washed often with warm water, and sprinkled with drying powders, such as chalk, burnt hartshorn; but especially tully, and cerufs, which may be tied closely in a rag, and the powders shook out on the disordered places,

If the parts affected are more sore, and tend to a real ulceration, it will be proper to add a little saccharum saturne to the powders. Likewise a little white vitriol dissolved in spring water, and daubed upon the part, will dry and heal it very powerfully.

#### *Of the STOPPAGE of the NOSE.*

THE nostrils of infants are often plugged up with a gross mucus, insomuch that they can scarce breathe, or suck, or swallow; which renders them very unquiet and uneasy. To cure it, after a suitable purge, dissolve two or three grains of white vitriol in half an ounce of marjoram water; then filtre it, and apply it now and then to the nostrils with a linen rag.

Or you may apply oil of sweet almonds, impregnated with the oil of marjoram, to the bottom and sides of the nostrils, which will resolve the filth, and render the respiration free.

#### *Of the SCABBY ERUPTIONS and CRUSTA LACTEA.*

THE heads of children are often troubled with achores or scabby eruptions; and if the face is affected with them, they are called crusta lactea. These are expelled by the benefit of nature; and, before the eruption, the infant is often troubled with epileptic fits from the irritation of the morbid matter.

If the humours strike in, either spontaneously or by improper applications, or if the exanthemata are of a blackish colour, they are very dangerous, and the infant generally falls into an asthma or a fatal epilepsy.

To the cure, externals, and especially such as are repellent, should be avoided; and things should be given inwardly which correct and temperate the blood, and expel the noxious matter by a diaphoresis. After the *prime viæ* are purged, both the nurse and child should take alexipharmics in the morning, and the testaceous powders with calx of antimony, amber, and cinnabar, in the afternoon.

Externally, nothing of sulphur or mercury should be applied, or repellent lotions, or any thing cold. To mollify the scabs, fresh butter, or calves marrow, or cream, are sufficient. This case often proves obstinate; and then the nurse should observe a strict regimen, use good diet, take sweeteners of the blood, and purgatives now and then.

#### *Of a DIARRHOEA and VOMITING.*

THE diarrhoea of infants is not to be stopped, either with astringents or narcotics: For astringents turn the flux of sharp humours towards the noble parts, and endanger the life of the child; and, though narcotics appease the ferocity of the turgescient humour for a time, yet they afterwards break out with greater force. Besides, opiates are too powerful for the tender constitution of infants, and must not be given at all, or with the utmost caution. In slight cases, diascordium may be ventured upon, to five or six grains; but, if there is a fever, it cannot be given without danger.

Therefore the best way is to give chalk, coral, pearls, and the like, of which about half a scruple is a dose; which will abate the orgasm of the humours, without kindling any new heat; after which the cure may be completed with rhubarb, from six grains to half a scruple, in solutive syrup of roses.

With regard to VOMITING, if there is great plenty of serous and noxious humours in the stomach, insomuch that the stomach can retain nothing, if the child is a year or two old, he may safely take some grains of ipecacuanha; Harris says xv: but surely a third part of that quantity, nay, one or two grains, may be sufficient; for this does not require the swallowing so much liquor after it as some others; and yet clears the stomach of crudities, viscidities, and other bad humours.

#### *Of Difficult BREEDING the TEETH.*

AMONG all the disorders which afflict children, there are none that generate such grievous symptoms as difficult dentition. About five or six months after birth, the teeth generally begin to make their appearance; first the incisors, or fore-teeth; next the canini, or dog-teeth; and lastly, the molares, or grinders. About the seventh year there comes a new set; and at twenty-one the two inner grinders, called dentes sapientie.

At the time of cutting their teeth, they slobber very much, and have a diarrhoea, which is no bad sign; but when it is difficult, especially when the canine teeth begin to be in motion, and to make their out-way out through the gums, the child has startings in his sleep, tumours of the gums, gripes, inquietude, watchings, a looseness or costiveness, greenish stools, the thrush, fevers, difficult breathing, suffocating catarrhs, convulsions, epilepsies, which often end in death.

It shews dentition is like to be bad, if the child is perpetually crying, thrusts his fingers into his mouth, and bites the nurse's nipples; if unequal tubercles are perceived in the gums, both by the sight and touch, where the teeth are expected to appear; if there is heat in the mouth and the whole body; if they start without a cause, especially in sleep. These do not come on without great flowering, and sometimes a diarrhoea, as was mentioned above.

Harris observes, that when an inflammation appears, the physician will labour in vain, if the cure is not begun with applying a leech under each ear. When the swelling of the gums shews it is time to cut it, to make way for the tooth, he would have it done with a penknife, not with a fine lancet, lest the wound should heal, and form a cicatrix. The food he directs to be no more than luke warm.

Heister internally advises aqueous mixtures, tempering powders; externally, oil of sweet almonds, with syrup of violets, or syrup of wild poppies, lightly acidulated with spirit of vitriol, wherewith often to rub the gums; as also with the coral or other smooth things, which will have the same effect.

Morgan affirms in this case, it will be best to abate the effervescence of the blood with diluters; to appease the pain with gentle opiates; to open the body with purges and clysters; to draw off the fermented serum by blisters; to promote the cutting of the teeth by cooling, relaxing, and opening the gums; for this purpose diacodium is good; or a strong decoction of marsh-mallows and poppy heads, in thick milk, cream, or neats-foot-oil: These take off the heat, and assuage the pain.

#### *Of the RICKETS.*

CHILDREN are seldom attacked with rickets before they are nine months, and after they are two years old; but it frequently happens in the intermediate space between these two periods. It may proceed originally from the disorders of the parents, and may be increased by those of the nurse.

It is likewise promoted by feeding the child with aqueous and mucous substances, crude summer-fruits, fish; by unleavened farinaceous aliment, and too great a quantity of sweet things; by an intermittent autumnal ague, or other chronic or acute disorders; by a striking in of the itch or herpes; by the suppression or injudicious cure of ulcers; by being enervated with baths, fomentations, ointments, or moist vapours; by continual rest in a perforated chair, with his coats up.

This disorder is known, in those who cannot walk,

from the causes preceding; from his brothers or sisters, having the same disease; from a flaccid tumour of the head and face; from a flabby loose skin; from a swelling of the abdomen; from a falling away of the rest of the parts, especially of the muscles; from protuberances of the epiphyses of the joints, such as the wrists, ankles, knees, elbows, &c.; from the magnitude of the jugular veins and arteries, while the rest decrease. The legs grow crooked.

In those that have begun to walk, besides the former signs, there is a slownels, debility, and tottering in his motion; which soon proceeds to a constant desire of sitting, and afterwards changes to lying down; insomuch that nothing at last is moveable, but the neck and head. Add to these, an early wit, an understanding which exceeds his age, while the appetite and digestion continue unhurt.

As he grows older, his head is enlarged, with ample sutures; his thorax is compressed on the sides; and his sternum rises up sharp, while the extremities of the ribs are knotty. The abdomen is protuberant, and the teeth black and carious. These disorders sensibly increasing, are the cause ever after of pernicious diseases of the same kind; principally a spina ventosa, and a caries of the bones.

In the mean while a slow feverish disorder preys upon the whole body, till the time of death; and then all the fibres, vessels, and viscera appear to be soft, flaccid, and the fluids dissolved and mucous.

The cure is to be attempted with light, nourishing, dry aliment, not fat, but seasoned, and taken often: With a little sound drink, such as beer, not stale, but well boiled and fine: With a dry warm air, and dry warm woolen cloathing: With being carried about in the arms, and often shook, swung, and put in motion: With being drawn in a vehicle over the stones: With repeated frictions with warm dry flannel, sprinkled with aromatics; especially the abdomen and spine of the back: With prudently repeated blisters, with strengthening purges, for several days successively: As also by the continued use of strengthening, drying, antiscorbutic remedies, and such as raise the spirits.

Particularly for food, the bread should be biscuit, with a little saffron and spices. The flesh should be pigeons, pullets, veal, rabbits, mutton, gently roasted, minced, and mixed with biscuit, salt, a little parsley, thyme, nutmeg, or the like.

Likewise rice, millet, pearl barley, boiled with raisins; to which add a little wine and spice. The drink may be generous French red wine, of which give an ounce three or four times a-day.

#### M E D

MEDICINES, whatever substances serve to restore health.

Medicines are either simple or compound: the former being formed by nature alone; and the latter owing to the industry of men, by variously mixing the simple ones together.

Medicines are likewise distinguished, from the manner of using them into internal or external; and with regard to their effects, they are said to be astringent, cathartic, emetic, &c.

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#### M E D

*Pocket-MEDICINES*, in surgery, those which a surgeon ought to carry always about him, in a box or convenient case.

Those, according to Heister, are the common digestive ointment, and the brown or Egyptian ointment, for cleansing and digesting foul ulcers, and some vulnerary balsams, as the linimentum aræi, or the balsam of Peru, of Gilead or Capiivi, or the Samaritan balsam: to these must also be added a plaster or two, as the

U a

diachylon,

diachylon, or stypticum Crollii, since one or other of these is almost constantly wanted. Neither should there be wanting a piece of blue vitriol for the taking down luxuriant flesh, and to stop hæmorrhages; but if vitriol is wanting, burnt alum, red precipitate, the infernal stone, or any other corrosive medicine, will supply its place in corrosive intentions, and the last will also serve to open abscesses, to make issues, and perform many other operations of that kind.

With these there should always be kept in readiness also a quantity of scraped lint, that the surgeon may be able to give immediate assistance to wounded persons; since, if he is unprepared for this, they may easily be taken off by an hæmorrhage; a circumstance which ought also to prevail with him to be always provided with suitable bandages.

MEDINA, a city of Arabia Deserta, situated two hundred miles north-west of Mecca: in E. long.  $40^{\circ} 35'$ . N. lat.  $24^{\circ} 30'$ .

This is called the city of the prophet, on account of Mahomet's being received and protected by the inhabitant's on his flight hither from Mecca, where the Mahometan æra commences.

MEDITERRANEAN SEA, extends from the straits of Gibraltar to the coasts of Syria and Palestine, being upwards of 2000 miles in length, but of a very unequal breadth; the west-part of it separates Europe from Africa; and the Levant or east-part of it divides Asia from Africa.

MEDITULLIUM, is used by anatomists for that spongy substance between the two plates of the cranium, and in the interstices of all laminated bones.

MEDIUM, in logic, the mean or middle term of a syllogism, being an argument, reason, or consideration for which we affirm or deny any thing: or, it is the cause why the greater extreme is affirmed or denied of the less in the conclusion.

MEDIUM, in arithmetic, or *arithmetical MEDIUM*, or *MEAN*, that which is equally distant from each extreme, or which exceeds the lesser extreme as much as it is exceeded by the greater, in respect of quantity not of proportion: thus 9 is a medium between 6 and 12.

MEDIUM, in philosophy, that space or region through which a body in motion passes to any point: thus air, is the medium wherein bodies move near our earth; water, the medium wherein fishes live and move; and glass is also a medium of light, as it affords it a free passage. That density or consistence in the parts of the medium, whereby the motion of bodies in it is retarded, is called the resistance of the medium; which together with the force of gravity, is the cause of the cessation of the motion of projectiles.

*Subtile or ætherial MEDIUM.* See ÆTHER.

MEDLAR, in botany. See MESPILUS.

MEDULLA, in anatomy. See ANATOMY, p. 147.

MEDULLA OBLONGATA. See ANATOMY, p. 287.

MEDULLA SPINALIS. See ANATOMY, p. 288.

MEDUSA, in zoology, a genus of insects belonging to the order of molusca. The body is gelatinous, roundish, and depressed; and the mouth is in the centre of the

under part of the body. There are twelve species, all natives of the sea.

MEDWAY, a river which rises in Ashdon forest in Sussex; and running through Kent, is divided into two branches by the Isle of Sheppy, one of which is called East Swale, and the other West Swale.

MEISSEN, once the capital of the marquisate of Mussen or Misnia, in Upper Saxony, on the river Elbe, ten miles north of Dresden.

MELAMPODIUM, in botany, a genus of the syngenesia polygamia necessaria class. The receptacle is paleaceous and conical; the pappus consists of one valve-shaped leaf, and the calix of five leaves. There are two species, both natives of Britain.

MELAMPYRUM, a genus of the didynamia angiospermia class. The calix has four segments; the upper lip of the corolla is compressed, and bent back at the edge; and the capsule has two oblique cells, containing two gibbous seeds. There are five species, four of them natives of Britain, *viz* the cristatum, or crested cow-wheat; the arvense, or purple cow-wheat; the pratense, or meadow cow-wheat; and the sylvaticum, or yellow cow-wheat.

MELANCHOLY, in medicine, a kind of delirium, attended with gloomy thoughts, heaviness, and sorrow. See MEDICINE.

MELANTERIA, in natural history, a very beautiful fossil of a dense, compact, and regular texture, and of an extremely bright pale yellow, resembling nothing so much as the purest gold: it is remarkably heavy, and is usually found in little irregular masses of the bigness of a pigeon's egg, which are broken with a slight blow: but it is usually met with in the form of a fine gold-coloured efflorescence or vitriolic and pyritical bodies; or in loose, shattery, and friable masses of a more dusky yellow; in which latter state it so much resembles a native sulphur, that it is frequently mistaken for one: however, it is not inflammable; but calcines in the fire to a greyish powder, which by burning longer changes to a deep and fine purple.

The Greeks used it externally, as a gentle escharotic and a styptic: they made it an ingredient in their ointments for old ulcers, and used to sprinkle the powder of it on fresh wounds to stop the hæmorrhage.

MELANTHIUM, in botany, a genus of the hexandria trigynia class. The corolla consists of six petals; and the filaments are composed of the long ungues of the corolla. There are three species, none of them natives of Britain.

MELANURUS, in ichthyology. See SPARUS.

MELASTOMA, in botany, a genus of the decandria monogynia class. The calix is bell-shaped, and has four segments; the petals are five, inserted into the calix; and the berry has five cells. There are twelve species, none of them natives of Britain.

MELCHITES, in church-history, the name given to the Syriac, Egyptian, and other Christians of the Levant. The Melchites, excepting some few points of little or no importance, which relate only to ceremonies and ecclesiastical discipline, are in every respect professed

professed Greeks; but they are governed by a particular patriarch, who resides at Damas, and assumes the title of patriarch of Antioch.

**MELCHISEDECIANS**, in church-history, a sect which arose about the beginning of the third century, and affirmed, that Melchisedek was not a man, but a heavenly power, superior to Jesus Christ: for Melchisedek, they said, was the intercessor and mediator of the angels; but Jesus Christ was so only for men, and his priesthood only a copy of that of Melchisedek.

**MELCOMB REGIS**, a borough-town of Dorsetshire, six miles south of Dorchester. It sends two members to parliament.

**MELEAGRIS**, the **TURKEY**, in ornithology. The head is covered with spongy caruncles; and there is likewise a membranaceous longitudinal caruncle on the throat. There are three species, *viz.* 1. The gallinavo, or North-American turkey of Ray, has a caruncle both on the head and throat; and the breast of the male is bearded. He lives upon grain and insects. When the cock struts, he blows up his breast, spreads and erects his feathers, relaxes the caruncle on the forehead, and the naked parts of the face and neck become intensely red. 2. The cristata, or Brasilian pheasant of Ray, has an erect crest of feathers on the head, and violet-coloured temples: it has a caruncle on the throat, but none on the head. 3. The satyra, or horned pheasant of Edwards, has two blue horns behind the eyes, a red body spotted with black and white. It is a native of Bengal.

**MELES**, in zoology. See **URSUS**.

**MELIA**, the **BEAD TREE**, in botany, a genus of the decandria monogynia class. The calix consists of 5 teeth, and the corolla of 5 petals; the nectarium is cylindrical, about the length of the corolla, and has ten teeth on the margin; and the drupa, which is shaped like an egg, has five cells. There are two species, none of them natives of Britain.

**MELIANTHUS**, in botany, a genus of the didynamia angiospermia class. The calix consists of five leaves; and the corolla of four petals, with a nectarium within the lowest one; and the capsule has four cells. There are two species, both natives of Æthiopia.

**MELICA**, in botany, a genus of the triandria digynia class. The calix consists of two valves, containing two flowers. There are three species, only one of which, *viz.* the nutans, or melic-grass, is a native of Britain.

**MELICERES**, in surgery, a kind of encysted tumours, so called when their contents are of the consistence of honey.

**MELILOT**. See **TRIFOLIUM**.

**MELINDA**, the capital of the province of the same name, and of all the Portuguese settlements on the coast of Malabar, in Africa: E. long. 39°, S. lat. 3°.

**MELINUM**, in natural history, the name of an earth, famous in the earliest ages of painting, being the only white of the great painters of antiquity; and, according to Pliny's account, one of the three colours with which alone they performed all their works. It is a fine, white, marly earth, of a very compact texture, yet remarkably light; a sort of texture which must render any earth fit for the painter's use, that is of a proper colour. It is frequently found forming a stratum in

the earth, lying immediately under the vegetable mould. It is of a very smooth, but not glossy surface, is very soft to the touch, adheres firmly to the tongue, is easily broken between the fingers, and stains the skin in handling. It melts readily in the mouth, and is perfectly fine, leaving not the least grittiness between the teeth. Thrown into water, it makes a great bubbling and loud hissing noise, and moulders away into a fine powder. It does not ferment with acids, and suffers no change in the fire. These are the characters by which the melinum of the ancients is distinguished from all the other white earths. It is still found in the same place from whence the painters of old had it; which is that from whence it has its name, the island of Milo, called Milos by the Greeks, and is common in most of the adjacent islands. It has been of late tried here as a paint, and is found not to make so bright a white as the other substances now in use among the painters; but seems not liable, like them, to turn yellow; and if so, would be worth the consideration of persons in the colour-trade, especially as it may be had in any quantities for carriage.

**MELISSA**, in botany, a genus of the didynamia gymnospermia class. The calix is dry, and plain above; the upper lip of the corolla is vaulted and bifid; and the middle lobe of the under lip is cordated. There are eight species, two of which are natives of Britain, *viz.* the calamintha, or common calaminth; and the repeta; or field calaminth.

**MELITENSIS TERRA**, *earth of Malta*, an earth of which there are two very different kinds; the one of the genus of the boles, the other of the marles. The latter is that known by medicinal authors under this name; the former is the Malta earth now in use: but both being brought from the same place, are confusedly called by the same name. The Maltese marle, which is the terra Melitenensis of medicinal authors, is a loose, crumbly, and very light earth, of an unequal and irregular texture, and, when exposed to the weather, soon falls into fine soft powder; but when preserved and dried, it becomes a loose, light mass, of a dirty white colour, with a greyish cast: it is rough to the touch, adheres firmly to the tongue, is very easily crumbled to powder between the fingers, and stains the hands. Thrown into water, it swells, and afterwards moulders away into a fine powder. It ferments very violently with acid menstruums.

Both kinds are found in great abundance in the island of Malta, and the latter has been much esteemed as a remedy against the bites of venomous animals, but with how much justice we cannot say. The other has supplied its place in the German shops, and is used there as a cordial, sudorific, and astringent. See **BOLE**.

**MELITIS**, in botany, a genus of the didynamia gymnospermia class. The calix is larger than the tube of the corolla; the upper lip of the corolla is plain; the under lip is crenated; and the antheræ are in the form of a cross. There is but one species, *viz.* the melisophyllum, or bastard baum.

**MELLER**, a large lake of Sweden, on the north side of which stands the capital city of Stockholm: it is eighty miles long, and thirty broad.

**MELOCHIA**, a genus of the monadelphia pentandria class.

- clafs. It has five ftyle; and the capsule has five cells, each containing one feed. There are fix fpecies, none of them natives of Britain.
- MELODY**, in mufick, the agreeable effect of different founds, ranged and difpofed in fucceffion; fo that melody is the effect of a fingle voice or inftrument, by which it is diftinguifhed from harmony.
- MELOE**, in zoology, agenus of infects of the order of coloptera. The antennæ are jointed, the laft joint being oval; the breaft is roundifh; the elytra are foft and flexible; and the head is infected and gibbous. There are 16 fpecies, principally diftinguifhed by their colour. The veficatorius, or cantharis of the fops, when bruifed, is univerfally ufed as a bliftering plafter.
- MELON**, in botany. See **CUCUMIS**.
- MELOTHRIA**, in botany, a genus of the triandria monogynia clafs. The calix confifts of five fegments; the corolla is monopetalous and bell fhaped; and the berry has one cell, containing many feeds.
- In Canada, Virginia, and Jamaica, where this fruit commonly grows, it is pickled for the table.
- MELTING CONE**, in affaying. See **CHEMISTRY**, p. 113.
- MEMBER**, in architecture, denotes any part of a building; as, a frieze, cornich, or the like. This word is alfo fometimes ufed for the moulding.
- MEMBER of parliament**. See **PARLIAMENT**.
- MEMBERED**, in heraldry, is where the legs or feet of an eagle, griffin, or other bird, are of a different colour from the reft of the body.
- MEMBRANE**, in anatomy, a pliable texture of fibres interwoven together in the fame plane. See **ANAT.** part I and II.
- MEMECYLON**, in botany, a genus of the octandria monogynia clafs. The calix is above the fruit, and has an entire margin; the corolla confifts of one petal; and the berry is crowned with a cylindrical calix. There is but one fpecies, a native of Ceylon.
- MEMOIRS**, in matters of literature, a fpecies of hiftory, written by perfons who had fome fhare in the tranfactions they relate; anfwering to what the Romans called *Commentarii*.
- MEMORY**, a faculty of the human mind, whereby it retains and recalls the ideas it has once perceived. See **METAPHYSICS**.
- MEMPHIS**, once the capital of Epypt, flood on the weft fide of the Nile, almoft oppofite to Grand Cairo.
- MENDICANTS**, or begging friers, feveral orders of religious in Popifh countries, who, having no fettled revenues, are fupported by the charitable contributions they receive from others.
- MENGRELIA**, a province of Afatic Turkey, fituated on the north-eaft part of the Euxine fea, between Georgia and Circaffia, where the Turks purchafe boys and young women for their feragios.
- MENIALS**, domeftic or houfehold fervants, who live under their lord or mafter's roof.
- MENINGES**, or **MENYNGES**, in anatomy, a name given to the dura and pia mater of the brain.
- MENISCUS**, in optics, a lens convex on one fide, and concave on the other. See **OPTICS**.
- MENSPEMUM**, in botany, a genus of the dicecia do-decandria clafs. The calix confifts of fix leaves, and the corolla of fix petals. It has three berries, containing each a kidney-fhaped feed. There are feven fpecies, none of them natives of Britain.
- MENNONITES**, a feft of baptifts in Holland, fo called from Mennon Simonis of Friezland, who lived in the fixteenth century. This feft believe, that the New Teftament is the only rule of faith; that the terms *Person* and *Trinity* are not to be ufed in fpeaking of the Father, Son, and Holy Ghoft; that the firft man was not created perfect; that it is unlawful to fwear, or to wage war upon any occafion; that infants are not the proper fubjects of baptifm; and that minifters of the gofpel ought to receive no falary.
- MENOLOGY**, the Greek calendar, in which the lives of the faints in fhort, or barely their names, are cited; anfwering nearly to the martyrology of the Latin church. See **MARTYROLOGY**.
- MENSA**, in law-books; a term that includes in it all patrimony, and neceffaries for livelihood.
- MENSALS**, in church-hiftory, fuch livings as were formerly united to the tables of religious houfes, and hence called *menfal benefices*.
- MENSES**, **FLOURS**, **COURSES**, *Catamenia*, in medicine, the monthly evacuations from the uterus of women not with child and not giving fuck. See **MEDICINE**.
- MENSTRUUM**, in chemiftry, any body which in a fluid or fubtilifed ftate is capable of interpofting its fmall parts betwixt the fmall parts of other bodies, fo as to divide them fubtilely, and form a new uniform compound of the two. See **CHEMISTRY**.
- MENSURATION**, in general, denotes the act or art of meafuring lines, fuperficies, or folids. See **GEOMETRY**.
- MENTHA**, in botany, a genus of the didynamia gym-nofpermia clafs. The corolla confifts of four fegments; and the ftamina are erect and diftant. There are 14 fpecies, 11 of them natives of Britain, *viz.* the *fpicata*, or *fpear-mint*; the *longifolia*, or *horfe-mint*; the *ro-rundifolia*, or *round leaved horfe-mint*; the *piperrita*, or *pepper mint*; the *gentilis*, or *red-mint*; the *verticillata*, or *curled-mint*; the *arvensis*, or *corn-mint*; the *exigua*, or *fmooth-mint*; the *aquatica*, or *water-mint*; the *hirsuta*, or *round-headed mint*; and the *pulegium*, or *penny-royal*.
- MENTZ**, the capital of one of the electorates of the fame name in Germany, fituated at the confluence of the rivers Rhine and Maine: E. long. 8°, and N. lat. 50°.
- MENYANTHES**, in botany, a genus of the pentandria monogynia clafs. The corolla is hairy; the ftigma is bifid; and the capsule has but one cell. There are three fpecies, two of which are natives of Britain, *viz.* the *trifolia*, or *buck-bean*; and the *nymphoides*, or *fringed water lilly*.
- MEOTIS**, or **PALUS MEOTIS**, a fea of Turkey which divides Europe from Affia, extending from Cum Tartary to the mouth of the river Don, or Tanais.
- MERCATOR'S SAILING**, that performed by Mercator's chart. See **NAVIGATION**.



*Fig. 1.* MANTLE



*Fig. 3.* MELIAGRIS  
or Horned Pheasant



*Fig. 2.* MARTLETS



*Fig. 4.* MERGUS or  
ROUND CRESTED DUCK



**MERCHANT**, a person who buys and sells commodities in grofs, or deals in exchanges; or that trafficks in the way of commerce, either by importation or exportation.

See **COMMERCE**.

**MERCURIAL**, something consisting of or relating to mercury.

**MERCURIALIS**, in botany, a genus of the dioecia erneandria class. The calix of both male and female consists of three segments; neither of them have any corolla; the stamina are from nine to twelve; the anthers are globular and didymous; the female has two styli; and the capsule has two cells, and one seed in each. There are four species, two of them natives of Britain, *viz.* the perennis, or dogs mercury; and the annua, or French mercury.

**MERCURY**, in natural history. See **CHEMISTRY**, p. 85. and 137.

**MERCURY**, ♀, in astronomy. See **ASTRONOMY**, p. 436.

**MERCURY**, in heraldry, a term used, in blazoning by planets, for the purple colour in the arms of sovereign princes.

**MERCY-SEAT**, in Jewish antiquity. See **PROPHETIA-TORY**.

**MERGUS**, in ornithology, a genus of birds, of the order of the anseres, distinguished by having the beak of a cylindrical figure, and hooked at the extremity, and its denticulations of a subulated form. There are six species of this genus, *viz.* 1. The cucullatus, or crested diver of Catesby, has a globular crest, white on each side; and the body is brown above, and white below. It is a native of America. See *Pl.* 110. 2. The mersanger, has a longitudinal crest, somewhat erect, a white breast, and a black head. It is a native of Europe. 3. The ferrator, has a hanging crest, a variegated brownish breast, and a white collar. It is a bird of Europe. 4. The cafter has a crested ash-coloured head, a white throat, and a black bill and legs. It inhabits the south of Europe. 5. The abellus, has a hanging crest, a black head and back, and white below. It is a bird of Europe. 6. The minutus, has a smooth gray head, with a black spot near the eyes. It is a native of Europe.

**MERIDIAN**. See **GEOGRAPHY**, and **ASTRONOMY**.

**MERIONETHSHIRE**, a county of north Wales, bounded by Caernarvon and Denbighshire on the north, by Montgomeryshire on the south east, and by the Irish sea on the west.

**MERIT**, signifies desert. This term is more particularly used to signify the moral goodness of the actions of men, and the rewards to which those actions intitle them.

**MERLIN**, in ornithology. See **FALCO**.

**MERLON**, in fortification, is that part of a parapet which is terminated by two embrasures of a battery.

**MERNS**, a county of Scotland, bounded by Mar on the north, by the German ocean on the east, by Angus on the south, and by Gowry on the west.

**MEROPS**, in ornithology, a genus belonging to the order of picæ. The bill is crooked, flat, and carinated; the tongue is jagged at the point; and the feet are of the walking kind. There six species, *viz.* 1. The a-

piaster, or bee-eater, has an iron-coloured back; the belly and tail are of a bluish green; and the throat is yellow. It inhabits the south of Europe. 2. The viridis, or Indian bee-eater, is green, with a black belt on the breast; and the throat and tail are black. 3. The congener is yellowish, with a green rump. It inhabits the south of Europe. 4. The superciliosus, is green, with a white line both above and below the eyes, and a yellow throat. It is found in Madagascar. 5. The cinereus, is variegated with red and yellow, with the two longest quill-feathers of the tail red. It is a native of America. 6. The cafer is grey, with a very long tail. It is a native of Æthiopia.

**MERSE**, a county of Scotland, bounded by Lothian on the north, by the German ocean on the east, by Northumberland and Tiviotdale on the south, and by Tweeddale on the west.

**MERULA**, in ornithology. See **TURDUS**.

**MESEEN**, the capital of a province of the same name, in Russia: it is a port-town, situated on the coast of the White sea, on hundred and fifty miles north east of Archangel.

**MESEMBRYANTHEMUM**, in botany, a genus of the icofandria pentagynia class. The calix consists of five segments, and the corolla of numerous linear petals; and the capsule is fleshy below the flower, and contains many seeds. There are 45 species, none of them natives of Britain.

**MESENTERY**, in anatomy. See **ANATOMY**, p. 262.

**MESNE**, in law, signifies him who is lord of a manor, and who hath tenants holding of him, yet himself holding of a superior lord.

**MESOCOLON**, in anatomy. See **ANATOMY**, p. 262.

**MESOLOGARITHMS**, according to Kepler, are the logarithms of the co-sines and co-tangents, the former of which were called by lord Napier antilogarithms, and the latter differentials.

**MESOPOTAMIA**, the ancient name of Diarbeck. See **DIARBECK**.

**MESOPTERYGIUS**, in ichthyology, a term applied to such fishes as have only one back-fin, and that situated in the middle of the back.

**MESPILUS**, in botany, a genus of the icofandria pentagynia class. The calix consists of five segments, and the corolla of five petals; the berry is below the flower, and contains five seeds. There are seven species, only one of which, *viz.* the germanica, or medlar, is a native of Britain.

**MESSASIPPI**, or **MESCHASIPPI**, a country of North America, bounded by Canada on the north, the British plantations on the east, the gulph of Mexico on the south, and the province of New Mexico on the west.

**MESSENGERS**, are certain officers chiefly employed under the direction of the secretaries of state, and always in readiness to be sent with all kinds of dispatches foreign and domestic. They also, by virtue of the secretaries warrants, take up persons for high treason, or other offences against the state.

**MESSIAH**, the **ANointed**; a title which the Jews gave to their expected great deliverer, whose coming they still wait for: and a name the Christians apply to Je-

fus Christ, in whom the prophecies relating to the Messiah were accomplished.

MESUA, in botany, a genus of the polyandria monogynia class. The calix has four leaves; the corolla four petals; and the capsule has four valves, containing four seeds. There is but one species, a native of India.

METACARPUS, in anatomy. See ANATOMY, p. 181.

METALS, in natural history, are defined to be fossile bodies, fusible by fire, concreting again in the cold, and malleable, or distensible and ductile under the hammer. See CHEMISTRY.

Semi-METALS, metallic fossils, fusible by fire, and not malleable in their purest state. See CHEMISTRY.

METAL, in heraldry. There are two metals used in heraldry, by way of colours, viz. gold and silver, in blazon called *or* and *argent*.

In the common painting of arms these metals are represented by white and yellow, which are the natural colours of those metals. In engraving, gold is expressed by dotting the coat, &c. all over; and silver, by leaving it quite blank.

It is a general rule in heraldry, never to place metal upon metal, nor colour upon colour; so that if the field be of one of the metals, the bearing must be of

some colour; and if the field be of any colour, the bearing must be of one of the metals.

METALLURGY, comprehends the whole art of preparing and working metals, from the glebe, or ore, to the utensil; in which sense, assaying, smelting, refining, smithery, gilding, &c. are only branches of metallurgy.

METAMORPHOSIS, in general, denotes the changing of something into a different form; in which sense it includes the transformation of insects. See NATURAL HISTORY.

METAPHOR, in rhetoric, a trope, by which we put a strange word for a proper word, by reason of its resemblance to it; or it may be defined, a simile or comparison intended to enforce and illustrate the thing we speak of, without the signs or forms of comparison. Thus, if we say, *God is a shield to good men*, it is a metaphor; because the sign of comparison is not expressed, though the resemblance which is the foundation of the trope, is plain; for as a shield guards him that bears it, against the attacks of an enemy, so the providence and favour of God protects good men from malice and misfortunes: but if the sentence be put thus, *God is as a shield to good men*, then it becomes a simile or comparison.

## M E T A P H Y S I C S.

METAPHYSICS is that part of philosophy which considers the nature and properties of thinking beings.

Aristotle, after treating on physics, begins his next book, (in which he pretends to elevate the mind above corporeal objects, to fix it on the contemplation of God, of angels, and of things spiritual, and to enable it to judge of the principles of sciences by abstraction,) with the Greek words *μετα τα φυσικα, post physicam*, i. e. *after metaphysics*. His disciples, and succeeding philosophers, have formed, of these two, one word, METAPHYSICS, by which they mean that science of which we have just now given the definition.

Metaphysics is divided, according to the objects that it considers, into six principal parts, which are called, 1. Ontology: 2. Cosmology: 3. Anthropology: 4. Psychology: 5. Pneumatology: and, 6. Theodicy, or metaphysical theology.

1. The doctrine that is named *Ontology*, is that part of metaphysics which investigates, and explains, the nature and general essence of all beings, as well as the qualities and attributes that essentially appertain to them, and which we ought to assign them by abstraction, as considering them *a priori*. Hence it appears, that this doctrine should proceed in its operations from the most simple ideas; such as do not admit of any other qualities of which they may be compounded. These simple ideas are, for example, those of being, of essence, of substance, of mode, of existence as well with regard to time as place,

of a necessary cause, of unity, the idea of negation, the difference between a being that is simple or compound, necessary or accidental, finite or infinite; the idea of essential and abstract properties, as of the greatness, perfection, and goodness of beings; and so of the rest. The business therefore of ontology, is to make us acquainted with every kind of being in its essence and abstract qualities, and such as are distinct from all other beings. This knowledge being once established on simple principles, just consequences may from thence be drawn, and those things proved after which metaphysics inquires, and which is its business to prove.

It is easy to conceive, that even a clear knowledge of beings, and their essential properties, would be still defective and useless to man, if he did not know how to determine and fix his ideas by proper denominations, and consequently to communicate his perceptions to those whom he would instruct, or against whom he is obliged to dispute, as they would not have the same perceptions that he has. It is, by the way, perhaps one of the greatest advantages that we have over other animals, to be able so to determine our ideas by signs or denominations, either of writing or speech, as to refer each particular perception to its general idea, and each general perception to its particular idea. To render therefore our ideas intelligible to others, we must have determinate words or denominations for each being, and the qualities of each being; and ontology teaches us those terms which are so necessary to fix our ideas, and to give them the requisite

requisite perspicuity and precision, that we may not dispute about words when we endeavour to extend the sphere of our knowledge, or when we debate concerning the essence of an object, or endeavour to make it more evident. It is for this reason that ontology was formerly regarded as a barren science, that consisted of technical terms only; as a mere terminology: whereas the best modern philosophers make it a more substantial science, by annexing determinate ideas to those words, and the examination of those objects themselves that these terms imply. But the misfortune is, to speak the truth, that in this ontologic determination there is still much uncertainty and sophistry. For, in the first place, we yet know of no metaphysics where all the definitions are just; and in the second place, the words that are employed in these definitions have always something equivocal in their meaning, and have consequently themselves need of definitions; and in this manner we may recede to infinity, unless we recur to the first impressions that the simple words have made in our minds, and the primitive ideas which they there excite. The words *man*, *love*, *coach*, &c. say more, and make a stronger impression, than all the definitions we can give of them; by ontologic explications they are almost always covered with a dark cloud.

2. Metaphysics, after having, in as solid a manner as possible, explained and established the principles above mentioned, continues its inquiries to the second part, that is called *Cosmology*, and examines into the essence of the world, and all that it contains; its eternal laws; of the nature of matter; of motion; of the nature of tangible bodies, of their attributes and essential qualities, and of all that can be known by abstraction, and sometimes also by adding the lights that man acquires concerning them by the experience of his senses. It is also in cosmology that we examine the Leibnitzian system; that is, whether God, in creating the world, must necessarily have created the best world; and if this world be so in effect. And in this manner they pursue the argument from consequence to consequence to its last resort. All philosophers, however, do not go equally deep. Each mind has its dose of penetration. Due care should be likewise taken, that subtilty, in this chain of reasoning, carried beyond the general bounds of the human mind, do not prejudice either the perspicuity or the truth of ideas: seeing that error here too nearly approaches the truth; and that every idea which cannot be rendered intelligible, is in effect equal to a false idea.

3. *Anthropology*, or the knowledge of man, forms the third branch of metaphysics. It is subdivided into two parts. The first, which consists in the knowledge of the exterior parts of the human frame, does not belong to this science: anatomy and physiology teach that. The business here is only a metaphysical examination of man, his existence, his essence, his essential qualities and necessary attributes, all considered *a priori*: and this examination leads at the same time to

4. *Psychology*, which is the fourth part of metaphysics, and consists in the knowledge of the soul in general, and of the soul of man in particular; concerning which, the most profound, the most subtle and abstract researches have been made, that the human reason is capable of pro-

ducing; and concerning the substance of which, in spite of all these efforts, it is yet extremely difficult to assert any thing that is rational, and still less any thing that is positive and well supported.

5. The fifth part of metaphysics is called *Pneumatology*. It is not a very long time since this term has been invented, and that metaphysicians have made of it a distinct doctrine. By this they mean the knowledge of all spirits, angels, &c. It is easy to conceive that infinite art is necessary to give an account of what we do not absolutely know any thing, and of which, by the nature of the subject itself, we never can know any thing. But the metaphysician presently offers to show us, "what is the idea of a spirit; the effective existence of a spirit; what are its general qualities and properties; that there are rational spirits, and that these rational spirits have qualities that are founded in the moral qualities of God:" for this is, in so many words, what is taught us by pneumatology or pneumatics.

6. *Metaphysical Theology*, which M. Leibnitz and some others call *Theodicy*, is the sixth and last doctrine of metaphysics. It teaches us the knowledge of the existence of God; to make the most rational suppositions concerning his divine essence, and to form a just idea of his qualities and perfections, and to demonstrate them by abstract reasoning *a priori*. Theodicy differs from natural theology, in as much as this last borrows, in fact, from theodicy, proofs and demonstrations to confirm the existence of a Supreme Being; but after having solidly established that great truth, by extending its consequences, natural theology teaches us what are the relations and connexions that subsist between that Supreme Being and man, and what are the moral duties that result from that connexion. As pneumatology is a science highly insidious and chimerical, so is metaphysical theology susceptible of found argument and demonstration; to the great comfort of mankind, the whole of whose happiness is founded on the certainty of this science. If the effects and operations of spirits in the universe were as evident as the effects and operations of the Deity, and their necessary existence as capable of being proved *a priori*, pneumatology would be a doctrine of equal certainty with theodicy: but as neither one nor the other can be proved, with regard to spirits in general, whilst God manifests himself in every part of nature, we have only to descend from the most simple and abstract ideas, to those that are the most compound; and from thence to ascend, by a chain of reasonings, from the creature up to the Author of the creature and of all nature: We shall find, that the result of all these operations of the mind will constantly be, The necessity of the existence of a God; and we may at all times determine, though very imperfectly, from the weakness of our discernment, what that Supreme Being must be, by positively determining what he cannot be. Every thing that can concur to furnish new proofs on this subject, or to elucidate and establish those which are already known, is therefore of inestimable value to mankind: and though this were the only object of metaphysics, it would highly merit the attention of those of the most refined and most exalted genius.

AFTER giving this general view of the subject, we shall proceed.

proceed to give the substance of what Mr Locke has delivered upon it.

*Of ideas in general, and their original.*

By the term *idea*, as defined by Mr Locke, is meant whatever is the object of the understanding when a man thinks, or whatever it is which the mind can be employed about in thinking.

In order to trace the manner by which we acquire these ideas, let us suppose the mind to be, as we say, *white paper*, void of all characters, without any *ideas*: how comes it to be furnished? whence has it all the materials of reason and knowledge? From *experience* and *observation*. This, when employed about external sensible objects, we may call *sensation*: by this we have the ideas of *bitter, sweet, yellow, hard, &c.* which are commonly called *sensible qualities*, because conveyed into the mind by the senses. The same experience, when employed about the internal operations of the mind, perceived and reflected on by us, we may call *reflection*: hence we have the *ideas* of *perception, thinking, doubting, willing, reasoning, &c.*

These two, viz. *external material things* as the objects of sensation, and *the operations of our own minds* as the objects of reflection, are the only *originals* from whence all our *ideas* take their beginnings: the understanding seems not to have the least glimmering of *ideas*, which it doth not receive from one of these two *sources*. These, when we have taken a full survey of them, and their several *modes* and compositions, we shall find to contain our whole stock of *ideas*; and that we have nothing in our minds which did not come in one of these two ways.

It is evident, that children come by degrees to be furnished with *ideas* from the objects they are conversant with: they are so surrounded with bodies that perpetually and diversely affect them, that some ideas will (whether they will or no) be imprinted on their minds. *Light* and *colours, sounds* and *tangible qualities*, do continually sollicit their proper senses, and force an entrance into the mind. It is late, commonly, before *children* come to have *ideas* of the operations of their minds; and some men have not any very clear or perfect *ideas* of the greatest part of them all their lives: because, though they pass there continually, yet, like floating visions, they make not deep impressions enough to leave in the mind clear and lasting *ideas*, till the understanding turns inward upon itself, and reflects on its own operation, and makes them the objects of its own contemplation.

When a man *first perceives*, then he may be said to *have ideas*; having *ideas*, and perception, signifying the same thing.

*Of simple ideas.*

Of ideas, some are *simple*, others *complex*. A *simple idea* is one uniform appearance or conception in the mind, which is not distinguishable into different *ideas*. Such are the *ideas* of *sensible qualities*, which though they are in the things themselves so united and blended, that there is no separation, no distance between them, yet the *ideas* they produce in the mind enter by the senses simple and unmixed. Thus, though the hand feels

*softness* and *warmth* in the same piece of *wax*, yet the *simple ideas* thus united in the same subject are as perfectly *distinct* as those that come in by different senses.

These *simple ideas* are suggested no other way than from the two ways above mentioned, viz. *sensation* and *reflection*.

The mind being once stored with the *simple ideas*, has the power to repeat, compare, and unite them to an infinite variety; and so can make, at pleasure, new *complex ideas*. But the most enlarged understanding cannot frame one new *simple idea*; nor by any force destroy them that are there.

*Of ideas of one sense.*

IDEAS, with reference to the different ways wherein they approach the mind, are of *four sorts*.

*First*, There are some which come into our minds by *one sense* only.

*Secondly*, There are others conveyed into the mind by *more senses than one*.

*Thirdly*, Others that are had from *reflection* only.

*Fourthly*, There are some suggested to the mind by all the ways of *sensation* and *reflection*.

First, some enter into the mind only by one sense peculiarly adapted to receive them. Thus colours, sounds, smells, &c. come in only by the eyes, ears, and nose. And if these organs are any of them so disordered as not to perform their functions, they have no other way to bring themselves in view, and be perceived by the understanding.

We shall here mention one, which we receive by our touch, because it is one of the chief ingredients in many of our complex ideas; and that is, the idea of *solidity*: it arises from the resistance one body makes to the entrance of another body into the place it possesses, till it has left it. There is no idea which we more constantly receive from sensation than this. In whatever posture we are, we feel somewhat that supports us, and hinders us from sinking downwards: and the bodies we daily handle, make us perceive, that while they remain between them, they do, by an unsurmountable force, hinder the approach of the parts of our hands that press them. This seems to be the most essential property of body, and that whereby we conceive it to fill space: the idea of which is, that where we imagine any space taken up by a solid substance, we conceive it so to possess it, that it excludes all other solid substances. This resistance is so great, that no force can surmount it. All the bodies in the world pressing a *drop of water* on all-sides, will never be able to overcome the resistance it makes to their approaching one another, till it be removed out of their way.

The idea of *solidity* is distinguished from that of *pure space*, in as much as this *latter* is neither capable of resistance nor motion: it is distinguished from *hardness*, in as much as hardness is a firm cohesion of the solid parts of matter making up masses of a sensible bulk, so that the whole doth not easily change its figure. Indeed, *hard* and *soft*, as commonly apprehended by us, are but *relative* to the constitutions of our bodies: that being called *hard* which will put us to pain sooner than change its figure by the pressure of any part of our bodies; and that *soft*, which

which changes the situation of its parts upon an easy and unpainful touch.

This difficulty of changing situation among the parts, gives no more solidity to the hardest body, than to the softest; nor is an adamant one jot more solid than water. He that shall fill a yielding soft body well with air or water, will quickly find its resistance. By this we may distinguish the idea of the extension of body, from the idea of the extension of space: That of body, is the cohesion or continuity of solid, separable, and moveable parts; that of space the continuity of unsolid, inseparable, and immoveable parts. Upon the solidity of bodies depends their mutual impulse, resistance, and protrusion.

#### *Of simple ideas of different senses.*

SOME ideas we get into the mind by more than one sense; as *space, extension, figure, rest, and motion*. These are perceivable by the eyes and touch.

#### *Of simple ideas of reflection.*

SOME ideas are had from reflection only: Such are the ideas we have of the operations of our minds; of which the two principal are, *perception, or thinking; and volition, or willing*. The powers of producing these operations are called *faculties*; which are, the *understanding, and will*. The several *modes* of thinking, &c. belong to this head.

#### *Of simple ideas of sensation and reflection.*

THERE are some simple ideas conveyed into the mind by all the ways of *sensation and reflection*; such are *pleasure, pain, power, existence, unity, succession*. Pleasure or delight, pain or uneasiness, accompany almost every impression on our senses, and every action or thought of the mind.

The Author of our beings having given a power to our minds, in several instances, to chuse amongst its ideas which it will think on; to excite us to these actions of *thinking and motion*, he has joined to several thoughts and sensations a perception of delight; without this we should have no reason to prefer one thought or action to another.

*Pain* has the same efficacy to set us on work that *pleasure* has; since we are as ready to avoid that, as to pursue this. This is worth our consideration, that *pain is often produced by the same objects and ideas that produce pleasure* in us. This their near conjunction gives us new occasion of admiring the wisdom and goodness of our *Maker*; who, designing the preservation of our being, has annexed pain to the application of many things to our bodies, to warn us of the harm they will do us, and as advices to withdraw us from them. But he not designing our preservation barely, but the preservation of every part and organ in its perfection, hath in many cases annexed pain to those very ideas which delight us. Thus heat, that is very agreeable to us in one degree, by a little greater increase of it proves no ordinary torment: Which is wisely ordered by *nature*, that when any object does by the vehemence of its operation disorder the instruments of sensation, whose structures cannot but be very delicate, we might by the pain be warn-

ed to withdraw before the organ be quite put out of order. That this is the *end of pain*, appears from this consideration; that though great light is insufferable to the eyes, yet the highest degree of *darkness* does not at all disengage them; because that causes no disorderly motion in that curious organ the eye. But excess of *cold*, as well as *heat*, pains us; because it is equally destructive to the temper which is necessary to the preservation of life.

*Existence and unity* are two other ideas suggested by every object without, and every idea within. When ideas are in our minds, we consider them as being actually there; as well as we consider things to be actually without us; which is, that they *exist*, or have existence: And whatever we consider as *one thing*, whether a *real being, or idea*, suggests the idea of *unity*.

*Power* is another idea derived from these sources: For finding in ourselves that we can *think, and move* several parts of our bodies at pleasure, and observing the *effects* that natural bodies produce in one another; by both these ways we get the idea of *power*.

*Succession* is another idea suggested by our senses, and by reflection on what passes in our minds: For if we look into ourselves, we shall find our *ideas* always, whilst we are awake, or have any thought, passing in train, one going and another coming, without intermission.

#### *Some farther considerations concerning simple ideas.*

WHATSOEVER is able, by affecting our senses, to cause any perception in the mind, doth thereby produce in the understanding a *simple idea*; which, whatsoever be the cause of it, is looked upon as a *real positive idea* in the understanding. Thus the ideas of *heat and cold, light and darkness, motion and rest, &c.* are equally positive in the mind, though some of their causes may be mere *privations*.

That a *privative* cause may produce a *positive* idea, appears from shadows; which (though nothing but the absence of light) are discernible, and cause clear and positive ideas. We have indeed some *negative* names which stand not directly for positive ideas, but for their absence; such as *insipid, silence*, which denote positive ideas, *viz. taste and sound*, with a signification of their absence.

It will be useful to distinguish *ideas* as they are *perceptions* in our minds, from what they are in the *bodies* that cause such perceptions in us; for we are not to think the former exact images and resemblances of something inherent in the subject, most of those of *sensation* being, in the mind, no more the likeness of something existing without us, than the names that stand for them are the likeness of our ideas, which yet, upon hearing, they excite in us.

Whatever the *mind perceives in itself*, or is the immediate object of perception, thought, or understanding, is an idea: And the power to produce any idea in our mind, is the *quality of the subject* wherein that power exists. Thus a *snow ball* having the power to produce in us the ideas of *white, cold, and round*; those *powers*, as they are in the snow-ball, are called *qualities*; and as they are *sensations or perceptions* in our understandings, they are called *ideas*. These *qualities* are of two sorts: First, *original, or primary*; such are *solidity, extension,*

*tension, motion, or rest, number, and figure.* These are inseparable from body, and such as it constantly keeps in all its changes and alterations.

Secondly, *Secondary qualities*; such as *colours, smells, tastes, sounds, &c.* which, whatever reality we by mistake may attribute to them, are in truth nothing in the objects themselves, but *powers* to produce various sensations in us; and depend on the qualities before mentioned.

The *ideas of primary qualities of bodies*, are resemblances of them; and their patterns really exist in bodies themselves: But the ideas produced in us by secondary qualities have no resemblance of them at all; and what is *sweet, blue, or warm*, in the idea, is but the certain bulk, figure, and motion of the insensible parts in the bodies themselves, which we call so.

Thus we see, that fire at one distance produces in us the sensation of *warmth*, which at a nearer approach causes the sensation of *pain*. Now what reason have we to say, that the idea of *warmth* is actually in the fire; but that of *pain* not in the fire; which the same fire produces in us the same way? The bulk, number, figure, and motion of the parts of fire, are really in it, whether we perceive them or no; and therefore may be called *real qualities*, because they really exist in that body: But *light* and *heat* are no more really in it, than sickness or pain: Take away the sensation of them; let not the eyes see light or colours, nor the ear hear sounds; let the palate not taste, or the nose smell; and all *colours, tastes, odours, and sounds*, as they are such particular ideas, vanish and cease, and are reduced to their causes, (that is,) bulk, motion, figure, &c. of parts.

These *secondary qualities* are of two sorts. First, *Immediately perceivable*; which by immediately operating on our bodies, produce several different ideas in us. Secondly, *Mediately perceivable*; which by operating on other bodies, change their primary qualities, so as to render them capable of producing ideas in us different from what they did before. These last are powers in bodies, which proceed from the particular constitution of those primary and original qualities, to make such a change in the *bulk, figure, texture, &c.* of another body, as to make it operate on our senses different from what it did before; as in fire, to make lead fluid. These two last being nothing but powers relating to other bodies, and resulting from the different modifications of the original qualities, are yet otherwise thought of; the former being esteemed *real qualities*, but the latter barely *powers*.

#### *Of perception.*

PERCEPTION is the first idea we receive from reflection: It is by some called *thinking* in general: Though *thinking*, in the propriety of the *English* tongue, signifies that sort of operation of the mind about its ideas, where-in the mind is active; where it considers any thing with some degree of voluntary attention: For in bare *perception* the mind is, for the most part, only *passive*; and what it perceives, it cannot avoid perceiving. What this is, we cannot otherwise know, than by reflecting on what passes in our minds when we see, feel, hear, &c.

Impressions made on the outward parts, if they are not taken notice of within, cause no *perception*; as we see in those whose minds are intently banded in the contemplation of certain objects.

We may observe that the ideas we receive from sensation, are often in grown people altered by the judgment, without our taking notice of it. Thus a globe of any uniform colour, (as of gold, or jet,) being set before our eyes, the *idea* thereby imprinted is of a flat circle variously shadowed: But being accustomed to perceive what kind of appearance convex bodies are wont to make in us, the judgment alters the appearances into their causes; and, from that variety of shadow or colour, frames to itself the perception of a convex figure of one uniform colour. This in many cases, by a settled habit, is performed so readily, that we take that for the perception of our sensation, which is but an idea formed by the judgment; so that one serves only to excite the other, and is scarce taken notice of itself: As a man who reads or hears with attention, takes little notice of the characters or sounds, but of the ideas that are excited in him by them.

Perception is also the first step and degree towards knowledge, and the inlet of all the materials of it; so that the fewer senses any man has, and the duller the impressions that are made by them are, the more remote he is from that knowledge which is to be found in other men.

#### *Of retention.*

THE next faculty of the mind whereby it makes a further progress towards knowledge, is called *retention*; which is the keeping of those ideas it has received. Which is done two ways:

First, By keeping the idea which is brought into the mind for some time actually in view; which is called *contemplation*.

Secondly, By reviving those ideas in our minds which have disappeared, and have been, as it were, laid out of sight: And this is *memory*; which is, as it were, the store-house of our ideas; for the narrow mind of man not being capable of having many ideas under view at once, it was necessary to have a repository to lay up those ideas, which at another time it may have use of. But our ideas being nothing but actual perceptions in the mind, which cease to be any thing when there is no perception of them, this lying up of our *ideas* in the repository of the memory signifies no more but this, that the mind has a power, in many cases, to revive perceptions it has once had, with this additional perception annexed to them, that it has had them before. And it is by the assistance of this faculty, that we are said to have all those ideas in our understandings which we can bring in sight, and make the objects of our thoughts, without the help of those sensible qualities which first imprinted them there.

Those ideas that are often refreshed by a frequent return of the objects or actions that produce them, fix themselves best in the memory, and remain longest there: Such are the *original qualities of bodies*, viz. Solidity, extension, figure, motion, &c. These and the like are seldom quite lost while the mind retains any *ideas* at all.

*Of discerning, and other operations of the mind.*

ANOTHER faculty of the mind, is that of *discerning between its ideas*. On this depends the evidence and certainty of several general propositions. In being able nicely to distinguish one thing from another, where there is the least difference, consists, in a great measure, that *exactness of judgment and clearness of reason* which is to be observed in one man above another.

To the well distinguishing our *ideas*, it chiefly contributes that they be clear and determinate; and when they are so, it will not breed any confusion or mistake about them, though the senses should convey them from the same object differently on different occasions.

The comparing of our *ideas* one with another in respect of *extent, degree, time, place*, or any other circumstances, is another operation of the mind about its *ideas* which is the ground of *relations*. Brutes seem not to have this faculty in any great degree. They have probably several *ideas* distinct enough; but cannot compare them farther than some sensible circumstances annexed to the objects themselves.

*Composition* is another operation of the mind, whereby it combines several of its simple *ideas* into *complex* ones: Under which operation we may reckon that of *enlarging*; wherein we put several *ideas* together of the same kind, as several units to make a *dozen*.

*Abstraction* is another operation of the mind, whereby the mind forms general *ideas* from such as it received from particular objects; which it does by considering them, as they are in the mind such appearances separate from the circumstances of real existence, as *time, place, &c.* These become general *representatives* of all of the same kind, and their names applicable to whatever exists conformable to such abstract *ideas*. Thus the colour received from *chalk, snow, and milk*, is made a representative of all of that kind; and has a name given it (*whiteness*;) which signifies the same quality, wherever to be found or imagined. And thus *universals*, both *ideas* and *terms*, are made.

*Of complex ideas.*

IN the reception of simple *ideas* the mind is only *passive* having no power to frame any one to itself, nor having any *idea* which does not wholly consist of them. But about these simple *ideas* it exerts several acts of its own, whereby out of them, as the materials and foundations of the rest, the other are framed: The acts of the mind, wherein it exerts its power over its simple *ideas*, are chiefly these three: *First*. It combines several simple *ideas* into one compound one; and thus all *complex ideas* are made. *Secondly*. It brings two *ideas*, whether *simple* or *complex*, together, and sets them by one another so as to take a view of them at once, without uniting them into one; by which way it gets all its *ideas* of *relations*. *Thirdly*. It separates them from all other *ideas* that accompany them in their real existence: And thus all its *general ideas* are made. As *simple ideas* are observed to exist in several combinations united together, so the mind may consider them as united, not only as they are really united in external objects, but as itself has joined them *Ideas* thus made up of several ones put together, are called

*complex*; as *man, army, beauty, gratitude, &c.* By this faculty of repeating and joining together its *ideas*, the mind has great power in varying and multiplying the objects of its thoughts. But it is still confined to those simple *ideas* which it received from the two sources of *sensation* and *reflection*. It can have no other *ideas* of sensible qualities, than what come from without by the senses, nor any other *ideas* of the operations of a thinking substance than what it finds in itself; but having once got these simple *ideas*, it can by its own power put them together, and make new *complex ones*, which it never received so united.

*Complex ideas*, however compounded and decomposed, though their number be infinite, and their variety endless, may all be reduced under these three heads: 1st, *Modes*; 2dly, *Substances*; 3dly, *Relations*.

1st, *Modes* are such *complex ideas* as contain not the supposition of subsisting by themselves but are considered as dependences on, and affections of substances; as *triangle, gratitude, murder, &c.* These modes are of two sorts: First, *Simple*; which are combinations of the same simple *idea*; as a *dozen, score, &c.* which are but the *ideas* of so many distinct units put together. Secondly, *Mixed*; which are compounded of simple *ideas* of several kinds; as *beauty*, which consists in a certain composition of colour and figure, causing delight in the beholder; *thrift*, which is the concealed change of the possession of any thing, without the consent of the proprietor. These visibly contain a combination of *ideas* of several kinds.

2dly, *Substances*. The *ideas* of substances are only such combinations of simple *ideas*, as are taken to represent distinct particular things subsisting by themselves, in which the confused *idea* of substance is always the chief. Thus a combination of the *ideas* of a certain figure, with the powers of motion, thought, and reasoning, joined to substance, make the ordinary *idea* of man.

These again are either of *single substances*, as *man, stone*; or of *collective*, or several put together, as *army, heap*. *Ideas* of several substances thus put together, are as much each of them one single *idea*, as that of a *man* or an *unit*.

3dly, *Relations*; which consist in the consideration and comparing of one *idea* with another. Of these several kinds we shall treat in their order.

*Of simple modes: And, first, of the simple modes of space.*

CONCERNING *simple modes* we may observe, that the modifications of any *simple ideas* are as perfectly different and distinct *ideas* in the mind, as those of the greatest distance or contrariety: Thus *two* is as distinct from *three*, as *blueness* from *heat*.

*Space* is a simple *idea* which we get both by our sight and touch. When we consider it barely in length between two bodies it is called *distance*: when in length, breadth, and thickness, it may be called *capacity*. When considered between the extremities of matter, which fills the capacity of space with something solid, tangible, and moveable, it is called *extension*. And thus *extension* will be an *idea* belonging to body; but *space* may be conceived without it.

Each

Each different *distance* is a different modification of space; and each *idea* of any different space is a *simple mode* of this *idea*. Such are an *inch*, *foot*, *yard*, &c. When these *ideas* are made familiar to mens thoughts, they can in their minds repeat them as often as they will, without joining to them the *idea* of body, and frame to themselves the *ideas* of feet, yards, or fathoms, beyond the utmost bounds of all bodies; and, by adding these still one to another, enlarge their *idea* of space as much as they please. From this power of repeating any *idea* of distance, without being ever able to come to an end, we come by the *idea* of immensity.

Another modification of *space* is taken from the *relation* of the parts of the termination of extension or circumscribed space amongst themselves; and this is what we call *figure*. This the *touch* discovers in *feasible* bodies, whose extremities come within our reach; and the *eye* takes both from bodies and colours, whose boundaries are within its view; where observing how the extremities terminate either in straight lines, which meet at discernible angles, or in crooked lines, wherein no angles can be perceived; by considering these as they relate to one another in all parts of the extremities of any body or space, it has that *idea* we call *figure*: which affords to the mind infinite variety.

Another *mode* belong to this head, is that of *place*. Our *idea* of *place* is nothing but the relative position of any thing with reference to its distance from some fixed and certain points. Whence we say, that a thing has or has not changed *place*, when its distance either is or is not altered with respect to those bodies which which we have occasion to compare it. That this is so, we may easily gather from hence, that we can have no *idea* of the *place* of the *universe*, though we can of all its parts. To say that the world is *somewhere*, means no more than that it does *exist*. The word *place* is sometimes take to signify that *space* which any body takes up; and so the *universe* may be conceived in a *place*.

#### *Of duration, and its simple modes.*

THERE is another sort of *distance*, the *idea* of which we get from the fleeting and perpetually perishing parts of succession, which we call *duration*. The simple modes of it are any different lengths of it whereof we have distinct *ideas*; as *hours*, *days*, *years*, &c. *time*, and *eternity*.

The *idea* of *succession* is got by reflecting on that train of *ideas* which constantly follow one another in our minds as long as we are awake. The distance between any parts of this *succession*, is what we call *duration*; and the continuation of the existence of ourselves, or any thing else, *commensurate* to the succession of any *ideas* in our minds, is what we call our *own duration*, or that of another thing co-existing with our thinking. That this is so, appears from hence, that we have no perception of succession or duration, when that succession of our *ideas* ceases, as, in *sleep*: the moment that we sleep, and awake, how distant soever, seems to be joined and connected. And possibly it would be so to a waking man, could he fix upon one *idea* without variation and the succession of others. And we see that they whose thoughts are

very intent upon one thing, let slip out of their account a good part of that *duration*, and think that time shorter than it is. But if a man, during his sleep, *dream*, and a variety of *ideas* make themselves perceptible to him, and one after another, he hath then, during such dreaming, a sense of *duration*, and of the length of it.

A man having once got this *idea* of duration, can apply it to things which exist while he does not think: and thus we measure the time of our sleep, as well as that wherein we are awake.

Duration, as marked by certain periods and measures, is what we most properly call *time*; which we measure by the diurnal and annual *revolutions* of the sun, as being constant, regular, and universally observable by all mankind, and supposed equal to one another.

The mind having once got such a measure of *time*, as the annual revolution of the sun, can easily apply it to duration, wherein that measure itself did not exist; and the *idea* of *duration* equal to an annual *revolution* of the sun, is as easily applicable in our thoughts to duration where no sun nor motion was, as the *idea* of a *foot* or *yard* to distances beyond the confines of the world.

By the same means, and from the same original that we come to have the *idea* of time, we have also that *idea* which we call *eternity*: for having got the *ideas* of certain lengths of duration, we can in our thoughts add them to one another as oft as we please, without ever coming to an end.

And thus it is plain, that from the two fountains of all knowledge before mentioned, *viz.* *sensation* and *reflection*, we get the *ideas* of duration, and the several measures of it.

#### *Of numbers.*

THE complex *ideas* of *number* are formed by adding several *units* together. The *simple modes* of it are each several combinations, as *two*, *three*, &c. These are of all others most distinct, the nearest being as clearly different from each other as the most remote: *two* being as distinct from *one*, as two hundred. But it is hard to form distinct *ideas* of every the least excess in extension. Hence demonstrations in numbers are more general in their use, and more determinate in their application, than those of extension.

*Simple modes* of numbers being in our minds but so many combinations of units, which have no variety but *more* or *less*; *names* for each distinct combination seem more necessary than in any other sort of *ideas*: For without a *name*, or *mark*, to distinguish that precise collection, it will hardly be kept from being a heap of confusion. Hence some *Americans* have no distinct *idea* of any number beyond twenty; so that when they are discoursed with of greater numbers, they shew the hairs of their head. So that to reckon right, two things are required:

*First*, That the mind distinguish carefully two *ideas* which are different one from another only by the addition or subtraction of one unit.

*Secondly*, That it retain in memory the names or marks of the several combinations, from an unit to that number; and that in exact order, as they follow one another. In either

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EXPLANATION OF THE TABLES.

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BLE. Shewing the manner in which natural bodies, considered in a chemical view, may be divided into classes: With their several subdivisions; their properties defined; and the manner in which they are obtained, pointed out.

	<p>SIMPLE, are those which can be no further analyzed by chemistry; and are of two sorts, viz.</p>	<p>ACIDS. These are distinguished by turning syrup of violets red, and forming with alkalis neutral salts. The different acids yet known are these.</p>	<p><i>Vitriolic.</i> { <i>Fixed.</i> The most ponderous of all fluids next to mercury, and the most fixed in the fire, and most powerful as a solvent of all the acids. Obtained chiefly from sulphur by inflammation. <i>Volatile.</i> Obtained also from sulphur by inflammation, air being admitted during the operation. This acts less powerfully as a solvent than when in its fixed state.  <i>Nitrous, or Aquafortis.</i> A volatile fluid of a reddish colour, emitting noxious fumes when in its concentrated state. The next acid in strength to the vitriolic. Obtained chiefly from nitre.  <i>Muriatic, or acid of sea-salt.</i> A volatile fluid of a beautiful yellow colour. Inferior in power to the former. Obtained from sea-salt.  <i>Vegetable.</i> { <i>Native.</i> This is obtained by expression or distillation from vegetables; as lemon-juice, citron, sorrel, &amp;c.  <i>Fermented.</i> { <i>Tartar.</i> A dry hard substance, deposited on the sides of vessels in which wine is fermented.  <i>Vinegar.</i> By allowing any fermentable liquor to proceed in the fermentation till it is past the vinous state. All these vegetable acids are much less corrosive, and less powerful as solvents, than any of the former.  <i>Acid of urine.</i> Obtained by evaporating urine. This is in a dry form; and much less known in arts than the former.  <i>Acid of amber.</i> Obtained from amber in a solid form. This is likewise little known in arts.  <i>Acid of ants.</i> Obtained from the animal from which it has its name, by distillation, in a fluid form. It is also little known.  <i>Acid of borax, or sedative salt.</i> Obtained from borax, in a solid state and scaly-like form.  <i>Acid of arsenic.</i> Obtained likewise from arsenic.  <i>Acid of animals.</i> Obtained from all animal-substances in distillation.</p>
<p>1. SALINE. These are soluble in water, rapid, and not inflammable. They are either</p>	<p>COMPOUND, consisting of two or more chemical elements. Divided into</p>	<p>ALKALIS, turn syrup of violets green, and with acids form neutrals; and are divided into</p>	<p><i>Fixed.</i> { <i>Vegetable, or potash.</i> Always obtained from the ashes of burnt vegetables. A deliquescent salt.  <i>Fossil.</i> A solid crystalline salt; sometimes found native, as the natrum of Egypt; and sometimes by burning sea-weed, as kelp.  <i>Volatile.</i> This is obtained from sal ammoniac, from the soot of burning bodies, and from the putrefactive fermentation. It is naturally in a solid state.</p> <p><i>Neutral salts.</i> These are always composed of an acid and an alkali; and are of many different kinds, as may be seen in the following table.  <i>Metallic salts,</i> are those which are formed by an acid and a metal. The principal of these are vitriols; the others may be seen in the following table.  <i>Earthy salts.</i> Composed of an acid joined to some earthy basis, as in allum and gypsum. See the following table.  <i>Essential salts,</i> are obtained from vegetables; and contain an acid, joined with the juices of the plant in a particular manner not to be imitated by art. Of this kind is sugar, manna, honey, and others of that sort.</p> <p><i>Expressed.</i> These are of a mild and bland taste, inodorous, and not soluble in alcohol. They are obtained by expression; as, oil of olives, rapeseed, almonds, &amp;c. Animal-fats are of the same nature, as is also wax.  <i>Essential,</i> are always obtained by distillation, and are possessed of the taste and odor of the substance from which they are drawn, and are soluble in alcohol. Of this kind are oil of cloves, spike, &amp;c. The oil of ants is an example in the animal-kingdom.  <i>Empyreumatic,</i> are obtained by a considerable degree of heat; and are of an acrid taste and burnt-like flavour, as oil of hartshorn. These are soluble in spirit of wine.</p> <p><i>Fossil.</i> These are found in the earth in their native state; and are called, when pure, <i>naphtha</i>; which is of an acrid taste, and extremely volatile; not miscible with alcohol. A great many inflammable fossils contain this; as, bitumens, pit-coal, &amp;c.</p> <p><i>SULPHUR, or brimstone.</i> A dry friable substance, not miscible with water. It is found in many mineral substances, metallic ores, &amp;c.; but it is for the most part obtained from pyrites.  <i>ALCOHOL, or ardent spirits.</i> A fluid of an acrid and volatile nature, miscible with water. Obtained from fermented vegetable juices by distillation; as, from the juice of the grape, malt-liquors, rice, &amp;c.</p>
<p>2. INFLAMMABLES, are those bodies that continue to burn of themselves if they are once set on fire. Divided into</p>	<p>OILS, are thickish viscid fluids, not miscible with water. Divided into</p>	<p>ANIMAL, both of which are divided into</p>	<p><i>Animal, Vegetable,</i> both of which are divided into  <i>Expressed.</i> These are of a mild and bland taste, inodorous, and not soluble in alcohol. They are obtained by expression; as, oil of olives, rapeseed, almonds, &amp;c. Animal-fats are of the same nature, as is also wax.  <i>Essential,</i> are always obtained by distillation, and are possessed of the taste and odor of the substance from which they are drawn, and are soluble in alcohol. Of this kind are oil of cloves, spike, &amp;c. The oil of ants is an example in the animal-kingdom.  <i>Empyreumatic,</i> are obtained by a considerable degree of heat; and are of an acrid taste and burnt-like flavour, as oil of hartshorn. These are soluble in spirit of wine.</p> <p><i>Fossil.</i> These are found in the earth in their native state; and are called, when pure, <i>naphtha</i>; which is of an acrid taste, and extremely volatile; not miscible with alcohol. A great many inflammable fossils contain this; as, bitumens, pit-coal, &amp;c.</p>
<p>3. METALLIC, are bodies of a hard and solid texture, fusible in the fire, and refusing their proper form after that; not miscible with water, nor inflammable. Divided into</p>	<p>METALS. These are malleable. Divided into</p>	<p>SEMI-METALS, are brittle, and do not stretch under the hammer; and are,</p>	<p><i>Gold.</i> The most ponderous and ductile, and the most fixed in the fire, of all bodies; of a yellow colour. It is more commonly found in its metallic state than any other metal. There is no proper ore of it: But it is found in ores of silver; and almost all sands contain some of it.  <i>Silver.</i> It is of a shining white colour, and next to gold in weight, malleability, and fixity. Sometimes found in its native state; more frequently in that of an ore, with sulphur, sometimes arsenic; assuming different appearances.  <i>Lead.</i> Of a dull bluish colour, exceeding soft, and easily malleable, and next to the foregoing metals in weight. Almost never found in its metallic state; usually in an ore with sulphur or arsenic, but seldom with sulphur alone. The principal ores of it are the cubic, called <i>galena</i>, and the glassy called <i>sparr</i>.  <i>Copper.</i> Of a reddish colour; hard and sonorous; admits of being extended greatly under the hammer, either hot or cold. It is difficult of fusion. This is generally found in the state of an ore with sulphur. The ores of it are of great variety, and extremely beautiful; blue, red, green, yellow, &amp;c.  <i>Tin.</i> A white soft metal, the lightest of all this class, and very ductile. The ores of this metal are generally arsenical, and assume a crystalline appearance. The colour most usually a dark brown, and sometimes very beautiful.  <i>Iron.</i> A grey-coloured metal, extremely ductile when hot; the lightest metal except tin. It is the only metal that admits of being welded, and tempered by cooling. It is found in almost every body, and its ores are infinitely various.  <i>Mercury.</i> A white opaque metallic body. Fluid, except in a very intense degree of cold; of great gravity, and easily volatilized in heat. It is sometimes found in its fluid form; but usually in a beautiful red ore with sulphur, called <i>cinnabar</i>.  <i>Zinc.</i> A bluish white substance, of a fibrous texture, considerably hard and sonorous, and has a small degree of ductility; easily fused and volatilized. Lapis calaminaris is its principal ore.  <i>Antimony.</i> A blackish substance, of a fibrous needle-like texture; hard and brittle, and considerably heavy; not difficult of fusion, and easily converted into glass. Its only ore is with sulphur, which is the crude antimony of the shops.  <i>Bismuth, or tin-glass.</i> A white, ponderous, hard, brittle, and sonorous body, of a plated texture; easily fused and vitrified. It is only reduced to an ore by arsenic. Its appearance much the same as the regulus.  <i>Arsenic.</i> A bright sparkling whitish-coloured semi-metal; of a plated texture, very brittle, and extremely volatile. It is generally found in the ores of other metals.  <i>Platina.</i> A white semi-metal, resembling silver in its colour; nearly of the same specific gravity and fixity with gold, and resisting the tests which have usually been applied for discovering the purity of gold, supposed from hence to be the <i>smiris</i> of the ancients. Found in the West Indies. Of its ores we know nothing.  <i>Cobalt.</i> A brittle semi-metal; fusible in a moderate heat, and easily converted into a fine blue-coloured glass called <i>smalt</i>. This is always obtained from an arsenical ore, which is likewise called <i>cobalt</i>.  <i>Nickel.</i> A reddish white substance, of a close texture, and very bright; easily fused, but difficult to vitrify. Of its ores we know nothing.</p>
<p>4. EARTHY. These are solid bodies; not soluble in water; not inflammable; and, if fused in the fire, never again resume their earthy form, but take that of glass. Divided into</p>	<p>ABSORBENT. These are capable of being united with acids; and are either</p>	<p>Not calcareous.</p>	<p><i>Calcareous.</i> Those that can be converted into quick-lime.  <i>Chalk.</i> A soft, friable, white substance. This is much freer of any heterogeneous mixture than any lime-stone, and is easily calcined into quick-lime. This is probably nothing else than lime-stone suddenly concreted without being crystallized.  <i>Sea-shells,</i> are likewise a calcareous earth, and yield a very fine quick-lime. These are used in medicine.  <i>Magnesia alba.</i> A white earth, usually found combined with the vitriolic acid, and forming bitter purging salt. It is likewise obtained from the mother-lye of nitre, the ashes of burnt vegetables, &amp;c.  <i>Earth of allum.</i> A particular kind of absorbent earth, found in many places mixed with sulphureous pyrites, as in Yorkshire, &amp;c. Clay of any kind may, by a particular process, be converted into this earth.  <i>Earth of animals, &amp;c.</i> This is obtained by the calcination of animal-substances. It can hardly be converted into glass; and is therefore used as a basis to white enamels, &amp;c.</p> <p>Of this kind are <i>sand, slint, &amp;c.</i> found plentifully every where. With alkaline substances they are easily converted into glass, and hence are termed <i>vitrescent</i>.  <i>Precious stones</i> of all kinds are likewise referable to this class; but they are of a much greater degree of hardness and transparency than the others.  <i>Common clay,</i> is of many different colours, but chiefly red or yellow or white. The purest clay is that which burns white in the fire.  <i>Medical boles,</i> of different sorts. Only a purer kind of clay; sometimes mixed with a little iron or other matters.  <i>Lapis nephriticus, or steatite,</i> are indurated clays, found in various parts. These are at first soft, and readily cut; but turn extremely hard in the air. Many other varieties of these earths might be mentioned; but as these do not differ in their chemical properties so much as in their external appearance, and being all mixed with one another, they more properly belong to the natural historian than the chemist.</p>
<p>5. WATER, a colourless insipid fluid well known.</p>	<p>SIMPLE. Pure rain-water. This is never perfectly pure, but always contains a small portion of mucilaginous matter, which it is impossible ever to get perfectly separated.</p>	<p>MINERAL, are those spring-waters impregnated with saline substances; the diversity of which is exceeding great; but they all agree in having an acid joined with them. The most common sorts are impregnated with sulphur and iron.</p>	<p><i>ELASTIC.</i> This is a subtle elastic fluid, every where surrounding this earth, and forming our atmosphere; and in this state may be considered as a menstruum for water and other volatile bodies; but as it only suspends them, without altering their qualities, it cannot properly, in this state, be considered as an object of chemistry.  <i>FIXT.</i> This is a fluid, supposed to be common air, which is absorbed by bodies, and there fixed; forming with them a true chemical mixt, differing in its properties from what it was without it. The bodies whose qualities we certainly know to be altered by this, are alkalis and quick-lime; and it is demonstratively present in metals: And it is probably owing to it that they retain their metallic form; but experiments are yet wanting here.</p>
<p>6. AIR.</p>			



METALS.

COPPER. A green deliquescent salt. By solution and imphating to acids. By solution. The iron is in some measure rendered volatile by this operation.

SEMI METALS.

MERCURY. A red fluid solution. By the ordinary means. It becomes green by a gentle heat. PLATINA. A fluid solution. With difficulty effected, after having been precipitated from aqua regia by alkalis. NICKEL. A green solution. By the ordinary means.

EARTHY.

CALCARIOUS. Liquid shell. By solution. A substance whose effects in medicine have been greatly extolled. Ol. calcis per deliquium. By evaporating liquid shell to drines. It naturally deliquesces. Fixt ammoniac. By solution and crystallization. This sometimes appears luminous in the dark when struck with a hammer.

WATER.

ACIDULATED WATER. Generating heat by mixture. VITRIOLIC, NITROUS, and MURIATIC, as in the above table. It likewise unites with all other acids, generating heat; but the properties or uses of these are not known.

ALKALIS.

VEGETABLE. Regenerated tartar. By solution and crystallization. FOSSILE. Polychreit of Rochelle. By ditto. VOLATILE. Spiritus mendacari. By solution.

OILS.

The union here is imperfect, nor have any of them obtained particular names.

ALCOHOL.

A mixture much used for anointing sprains, &c. SILVER. Lunar caustic. By dissolving in this acid a precipitate of silver from the vitriolic acid by means of fixt alkali, and evaporating the solution to drines.

METALS.

COPPER. Verdegris. By solution and crystallization; or at large, by stratifying copper plates with the husks of the grape. IRON. Sal martis aperiens. By solution and crystallization. LEAD. Ceruse. By exposing, in certain circumstances, thin plates of lead to the fumes of vinegar. Saccharum Saturni. By solution and crystallization.

SEMI-METALS.

TIN. This is not properly dissolved; but the acid is evidently impregnated. By the ordinary means of solution. ZINC. A colourless solution of a sweetish taste. By digesting for some time. MERCURY. A fluid solution. By employing a precipitate of mercury from the nitrous acid by alkalis. A red calx. By long digestion with fluid mercury.

EARTHY.

ANTIMONY. Vinum benedictum. This is not a proper solution of the metal, but the acid is impregnated with an emetic quality. ARSENIC. Vinum arsenicum. By ditto. BISMUTH. An austere stiptic liquor. By strong coction. CALCARIOUS EARTHS. Earthy salts. Not known in medicine or arts. MAGNESIA. Dr Black's purging salt. By solution. It unites with all the other absorbent earths; but the properties of these mixts are unknown.

WATER.

ACIDULATED WATER. The nature of these not known. VOLATILE. A glass-like saline substance called microcosmic salt. The acid is always found in this state by evaporating urine.

ACID of URINE.

OILS. Baldwin's phosphorus. By distilling with substances that contain oils or inflammable matters. LEAD. An inflammable malleable mass. By calcining the dry salt with lead. TIN. A mass resembling zinc, and inflammable. By ditto.

METALS.

IRON. A true phosphorus. By ditto. A bluish solution. By employing a watery solution of the acid. COPPER. A corroded powder, or green solution. By a boiling heat in a watery solution of the acid. MERCURY. A semi-opaque mass. By fusion with the acid in its solid form.

SEMI-METALS.

ZINC. A corroded powder, soluble in water. By solution in the acid in a watery situation. A true phosphorus. By fusion with the dry acid. ANTIMONY. A solution in the ordinary way. A brilliant striated mass. By fusion with the dry acid. BISMUTH. A mixture but little changed in appearance from ordinary bismuth. By fusion. ARSENIC. A whitish semi-transparent deliquescent mass. By fusion. COBALT. A reddish tincture. By solution.

ACID of AMBER.

FIXED. A neutral saline mass which would not crystallize. By solution. VOLATILE. A neutral ammoniacal oleaginous liquor, extremely volatile. By solution with a pure alkali. LIQUOR CORNU CERVI SUCCINATUS. By solution, using salt of hartshorn.

METALS.

COPPER. It dissolves very slowly in its metallic state; but corrodes it much more readily when calcined. IRON. Dissolves a part into a colourless liquor, but corrodes a great deal more into a crocus.

SEMI-METAL.

ZINC. A fluid solution. The effects of this acid upon other bodies are not yet known.

ACID of ANTS.

ACIDS of all kinds. The properties not known. FIXED. A deliquescent neutral salt. By solution and crystallization. VOLATILE. A neutral liquor that would not crystallize. SILVER. By solution. The calx of silver precipitated from aqua fortis by alkalis; but does not act upon it in its metallic state. COPPER. Beautiful green crystals. By dissolving and crystallizing calcined copper. It acts slowly upon it in its metallic state. IRON. A metallic salt. It dissolves this metal with great facility. LEAD. A salt resembling Saccharum Saturni. By dissolving the red calx of lead. But it does not act upon it in its metallic state. ZINC. Elegant crystals. By the ordinary means.

ACID of BORAX.

The effects of this acid upon other bodies, or the uses to which these combinations might be applied, are not yet sufficiently known. FOSSILE. Borax. A native substance, which may be imitated by art. It is of great use in promoting the fusion of metals and earths. A solution with a considerable heat, which burns with a green flame. A solution in a considerable heat. The other mixtures with this acid not known.

ACID of ANIMALS.

We know as yet but little of the nature of this acid; and its combinations with other bodies have not hitherto been examined.

THE FIXED ALKALI, whether VEGETABLE or FOSSILE, can be united with the following bodies; but the vegetable is best known.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; and acid of Urine, of Amber, of Ants, of Borax; as in the former part of this table. ALKALIS of all sorts. The uses of these mixtures are not known. EXPRESSET. Soap. The best hard soap is made of olive-oil and fossile alkali. The ordinary white soap of this country is made of tallow and potash; black soap, with whale-oil and potash.

OILS.

ESSENTIAL. Saponaceous mass. Best made by pouring spirit of wine upon caustic alkali and then oil, digesting and shaking. EMPYREUMATIC. This mixture dissolves gold when precipitated from aqua regia; and is the basis of the fine colour called Prussian blue; and has various other properties, as yet but little known. FOSSILE. This has no name, nor are the properties well known; but from some observations that have been made on native soapy waters, it is probable that it would keep linen much longer white than any other kind of soap.

SULPHUR.

Hepar sulphuris. By injecting alkalis upon melted sulphur. Lac sulphuris. By dissolving sulphur in an alkaline lixivium, and precipitating by an acid.

METALS.

GOLD. After having precipitated it from aqua regia it dissolves it, if the alkali has been calcined with animal-substances. SILVER. After having precipitated it from the nitrous acid, it dissolves it if the alkali has been calcined in contact with the flame. TIN. A corroded powder. By the ordinary means of solution. COPPER. By ditto. LEAD. A fluid solution. By ditto. This stains hair black. IRON. A blood-coloured solution. By dropping a solution of iron in the nitrous acid, into an alkaline lixivium. MERCURY. A fluid solution. After precipitating it from acids; if the alkali is in too large proportions, it then dissolves it, especially if the alkali has been calcined in contact with the flame. ZINC. By solution, after having precipitated it from the nitrous acid. BISMUTH. By solution, after having precipitated it from the nitrous acid.

SEMI-METALS.

Kermes mineral. By dissolving antimony in an alkaline lixivium, filtering, and allowing it to stand in a cool place till it precipitates. Golden sulphur of antimony. By dissolving a crude antimony in an alkaline lixivium, and precipitating by an acid. Hepar antimonii. By deflagrating crude antimony with nitre. Crocus martis. Is hepar antimonii pulverized and edulcorated with water. Diaphoretic antimony. By deflagrating regulus of antimony with nitre. Antimoniated nitre. By dissolving diaphoretic antimony in water, and allowing it to crystallize. Magistery of antimony. By precipitating a solution of diaphoretic antimony by adding vinegar. Regulus antimonii medicinalis. By fusing crude antimony with alkali. This is not properly a compound of alkali and antimony, but of another kind. But as it is a term much used, it was proper to explain it. ARSENIC. A metallic-arsenical salt. By a particular elective attraction from regulus of antimony and nitre.

EARTHS.

CHRYSALLINE. Liquor silicium. By fusion with twice their weight of alkalis. GLASS. By fusion with a much smaller proportion of alkali. This is the composition of crystal glass, and all others commonly used. ABSORBENTS. Argillaceous, and all kinds of earths. Glass. By fusion; differing in quality according to the nature of the ingredients. Glass is likewise produced with it in fusion with metals.

WATER.

ALKALINE LIXIVIAM. when caustic, or even the ordinary solution of mild alkali, is a fluid of great power in washing, blacking, &c.

AIR.

FIXT. Mild alkali. This is the general state in which alkalis are found; but if they are rendered caustic by means of quick-lime or otherwise, they again absorb it from the air, or from many other bodies, by elective attraction. When perfectly mild, this alkali may be made to assume a crystalline form.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable; of Urine, of Amber, of Ants.

ALKALI, as above.

OILS.

EXPRESSED. Has no name. By solution. ESSENTIAL. Sal volatile oleosum. By ditto with some difficulty, unless the alkali is in a caustic state. EMPYREUMATIC. A pungent oily substance, of great power in medicine. The principal one of this kind in use is spirit of hartshorn. FOSSILE. A particular kind of soapy substance.

SULPHUR.

Smoking spirit of sulphur. By distilling sal ammoniac, quick-lime, and sulphur. By distilling alcohol from volatile alkalis, it acquires a caustic fiery taste; but the union is not complete.

ALCOHOL.

GOLD. Aurum fulminans. A powder obtained by precipitating it from aqua regia by volatile alkalis. A liquid solution. By adding a large proportion of alkali after it has been precipitated from aqua regia. This deposits the gold when long exposed to the air. The curious vegetation called arbor Diana is formed by adding mercury to this solution. SILVER. A solution. After it has been precipitated from the nitrous acid. A blue-coloured solution. By the ordinary means. This when evaporated to drines, and mixed with tallow, tinges the flame green. COPPER. Sapphire-coloured crystals. By crystallizing the solution. Venus fulminans. By evaporating the solution to drines. Aqua corulea sappharina. By mixing sal ammoniac, quick-lime, and thin plates of copper, with water, and allowing them to remain a night.

METALS.

IRON. By ordinary solution. LEAD. By ditto. TIN. The mixts that are produced by these metals are little known. BISMUTH. By solution, after having precipitated it from the nitrous acid. ANTIMONY. PLATINA. By solution, after having precipitated it from aqua regia. COBALT. A reddish liquor. By solution. NICKEL. A blue liquor. By ditto.

WATER.

This solution might be of use in washing or bleaching; but, unless in particular cases, would be too expensive. It coagulates with alcohol.

AIR.

FIXT. Mild volatile alkali. The usual state in which it is found; nor has any method yet been discovered of rendering it solid but in this state.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, as in the foregoing part of this table.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS: Essential, Empyreumatic, and Fossile. By mixture; but their uses are not much known.  
 SULPHUR. Balsam of Sulphur. By solution in a boiling heat.  
 ALCOHOL. After expressed oils are freed from soap or plaisters, they are soluble in alcohol; but not in their ordinary state.

EXPRESSED OILS.  
 METALS. { TIN\*. A kind of plaister. By solution when the tin is in the state of a calx.  
 { LEAD\*. Ditto. By boiling the calx of lead in oils. This is used for cements in water-works. The common white paint is a mixture of this less perfect.  
 SEMI-METALS. ZINC\*. Ditto. By ditto.  
 CALCARIOUS EARTHS. Ditto. By mixture when in a caustic state.

ACIDS: Vitriolic, Nitrous, &c. as above.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS of all kinds. By solution or mixture.  
 SULPHUR. A balsam of sulphur. By solution, imperfectly: better by adding essential oils to the solution made by expressed oils or hepar sulphuris.

ESSENTIAL OILS.  
 ALCOHOL. { In perfect mixture. By solution.  
 { Aromatic waters. By distillation.  
 METALS. { COPPER. By solution.  
 { LEAD. By ditto.  
 WATER. Distilled water of the shops. By distilling recent vegetable substances with water.

PYRENEUTIC OILS.  
 ACIDS: Vitriolic, and Nitrous, as above.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS of all kinds. By mixture.  
 ALCOHOL. By solution. By repeated distillations the oils are rendered much more subtle.

FOSSILE OILS.  
 ACIDS: Vitriolic, and Nitrous, as above.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS of all kinds. By mixture.  
 SULPHUR. With some difficulty, by solution.  
 ALCOHOL. By ditto.

ACID\*: Vitriolic; with the phenomena above described.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS: Expressed, Essential, and Fossile, as above.

SILVER. A mass of a red like colour. By adding sulphur to red-hot silver, and fusing; found also with it in the state of an ore.  
 LEAD. A sparkling friable mass, hardly fusible. By deflagrating sulphur with lead. This in a native state forms the ore of lead called galena.  
 COPPER. A black brittle mass; easily fused. By adding sulphur to red-hot copper, or stratifying with sulphur and fusing. Naturally in some yellow pyrites.  
 A spongy-like dross, easily fusible. By putting sulphur to red-hot iron. This is also found naturally in the common yellow or brown pyrites.  
 A fulminating compound. By mixing filings of iron with sulphur, moistening them with water, and pressing them hard, they in a few hours burst out into flame. This composition has been employed for imitating earthquakes.

METALS.  
 IRON. { Crocus martis. By deflagrating with iron.  
 { Crocus martis apoviens. By calcining the crocus martis in the fire till it assumes a red appearance.  
 { Crocus martis astringens. By pushing the heat still further.  
 TIN. A dark-coloured mass, resembling antimony. By fusion.

SULPHUR.  
 MERCURY. { Ethiops mineral. By heating flowers of sulphur, and pouring the mercury upon it, and stirring it well. Its natural ore is called cinnabar.  
 { Fatitious cinnabar. By applying the mercury and sulphur to each other in their pure state, and subliming.  
 { Cinnabar of antimony. By subliming corrosive sublimate and crude antimony; or the residuum, after distilling butter of antimony.  
 BISMUTH. A faint greyish mass, resembling antimony. By fusion. If in its metalline state, the sulphur separates in the cold; but not so if the calx has been employed.  
 ANTIMONY. Crude antimony. By fusion.

SEMI-METALS.  
 ZINC\*. A very brittle, dark-coloured, shining substance. With some difficulty, by keeping it long in a moderate fire, and covering it several times with sulphur, and keeping it constantly stirred.  
 ARSENIC. { Yellow arsenic. By fusing it with 1-10th its weight of sulphur.  
 { Red arsenic. By ditto with 1-5th its weight of sulphur.  
 { Ruby of sulphur, or arsenic, or golden sulphur. By subliming when the proportions are equal.  
 { Orpiment. A natural production; not perfectly imitable by art; composed of sulphur and arsenic. Much used as a yellow paint.  
 NICKEL. A compound; compact and hard as lead; of a bright metallic appearance; internally yellow. By fusion.  
 Gas sylvestris. By receiving the fumes of burning sulphur in water. This ought rather to be called a union of the volatile vitriolic acid with water.

WATER.  
 ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, and of Borax, as above.  
 ALKALI\*: Volatile, as above.  
 OILS: Expressed, Essential, Empyreumatic, and Fossile, as above.  
 METALLIC calces, in some particular cases.  
 WATER. By solution.

ALCOHOL.  
 ACIDS: Vitriolic\*, Nitrous\*, and Muriatic\*. In the circumstances and with the phenomena above described.  
 ALKALIS: Fixt\*, and Volatile\*, as above.

METALS.  
 SILVER. By fusion. And the same is to be understood of all the combinations of metals, unless particularly specified.  
 LEAD. A very brittle mass. Gold is rendered pale by the least admixture with this.  
 TIN. Remarkably brittle. The smallest particle of tin falling upon a furnace renders all the gold or silver melted in it extremely brittle.  
 COPPER. Paler and harder than pure gold. This mixture is used in all our coins, the copper being called the alloy.  
 IRON. Silver-coloured, hard and brittle; very easily fused.  
 MERCURY. Soft like a paste called an amalgamum. By solution; it being in this case called amalgamation; and the same is to be understood of the solution of any other metal in quick-silver.  
 ZINC. A bright and whitish compound, admitting of a fine polish, and not subject to tarnish; for which qualities it has been proposed as proper for analyzing speculi for telescopes.  
 ARSENIC. Brittle; and the gold is thus rendered a little volatile.  
 ANTIMONY. A fine powder for staining glass of a red colour. By calcination.

GOLD.  
 SEMI-METALS.  
 BISMUTH\*. A brittle whitish regulus; volatile in the fire.  
 PLATINA. Ductile, and of a dusky colour. This has been employed to debase gold, as it is of the same specific gravity, and is not discoverable by the usual tests for discovering the purity of gold.  
 COBALT.  
 NICKEL. White and brittle.

ACIDS: Vitriolic\*, Nitrous, Muriatic\*, Vegetable\*, and Acid of Ants\*, as above.  
 ALKALIS: Fixt\*, and Volatile\*, as above.  
 SULPHUR, as above.

METALS.  
 GOLD, as above.  
 LEAD. Very brittle.  
 TIN. Extremely brittle, as much so as glass.  
 COPPER. Harder than silver alone. Used in small proportions as alloy in coins.  
 IRON. A hard whitish compound.

SILVER.  
 MERCURY. By amalgamation with silver leaf, or calx of silver precipitated by copper, but not by salt. This is used for silverizing on other metals, in the same way as the amalgamum of gold.  
 ZINC. Hard, somewhat malleable, and of a white colour.

SEMI-METALS.  
 ANTIMONY. A brittle mass.  
 BISMUTH. A whitish semi-malleable body.  
 ARSENIC. Brittle; the silver being rendered in part volatile.  
 PLATINA. Pretty pure and malleable. Difficult of fusion; and in part separates when cold.  
 COBALT.

CRYSTALLINE EARTHS, and other vitreous matters. A fine yellow opaque glass. The finest yellow paint for porcelain is procured from a glass mixed with silver.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Ants\*, as above.  
 ALKALIS: Fixt, and Volatile, as above.  
 OILS: Expressed\*, and Essential, as above.  
 SULPHUR, as above.

METALS.  
 GOLD and Silver, as above.  
 TIN. A little harder than either of the metals, and easily fused: hence it is used as a solder for lead; and it forms the principal ingredients of pewter. If the fire is long continued, the tin floats on the surface.  
 COPPER\*. Brittle and granulated, like tempered iron or steel when broke. By throwing pieces of copper into melted lead. The union here is very slight.  
 IRON\*. An opaque brownish glass. By a great degree of heat if the iron has been previously reduced to the state of a calx; but never in its metallic state.  
 MERCURY\*. By amalgamation. Effected only in a melting heat, unless some bismuth has been previously united with the mercury.  
 ZINC. Hard and brittle. By pouring zinc on melted lead. If the zinc is first melted, and the lead injected upon it, it then deflagrates.  
 ANTIMONY\*.  
 BISMUTH. A grey-coloured semi-malleable body, easily fused; and thence used as a solder for lead or tin.

SEMI-METALS.  
 ARSENIC. { A grey-coloured brittle mass; easily fused, and extremely volatile.  
 { A hyacinth-coloured glass. By fusion in a considerable heat. This glass is easily fused; and is a much more powerful flux than pure glass of lead.  
 PLATINA. Of a leafy or fibrous texture, and purplish or blue colour, when exposed to the air. If a large proportion of platina is used, it separates in the cold.  
 COBALT. The nature of this compound is not known.  
 NICKEL. A brittle metallic body.

CRYSTALLINE EARTHS. A thin glass. By fusion in a moderate heat.

ACIDS: Vitriolic\*, Nitrous\*, Muriatic, Vegetable\*, of Urine, as above.  
 ALKALIS: Fixt, and Volatile, as above.  
 OIL: Expressed\*, as above.  
 SULPHUR, as above.

METALS.  
 GOLD, Silver, and Lead, as above.  
 COPPER. A brittle mass. When the copper is in small proportions, it is firmer and harder than pure tin. This in right proportions with a little zinc, forms bell-metal.  
 IRON. A white brittle compound. By heating filings of iron red-hot, and pouring melted tin upon them. A metal resembling the finest silver is made of iron, tin, and a certain proportion of arsenic.

TIN.  
 MERCURY. This amalgamum forms foils for mirrors; and forms the yellow pigment called aurum mosaicum. By being sublimed with sulphur and sal ammoniac.  
 ZINC. Hard and brittle. When the zinc is in small proportions, it forms a very fine kind of pewter.  
 ANTIMONY\*. Regulus veneris. By elective attraction from copper and crude antimony.  
 BISMUTH. Bright, hard, and sonorous, when a small proportion of bismuth is used. This is very easily fused; and employed as a solder.  
 ARSENIC. A substance in external appearance resembling zinc.  
 PLATINA. A coarse hard metal which tarnishes in the air.  
 COBALT. By fusion.  
 NICKEL. A brittle metallic mass.

CRYSTALLINE EARTHS, or other vitreous matters. An opaque white vitreous mass, which forms the basis of white enamel.

ACIDS: Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.  
 ALKALIS: Fixt, and Volatile, as above.

METAL.  
 IRON. Harder and paler than copper.

ALKALIS: Fixed, and Volatile, as above.  
OIL: Essential, as above.  
SULPHUR, as above.

METAL.	IRON. Harder and paler than copper. Easily fused. MERCURY *. A curious amalgum. Soft at first, but afterward brittle. By triturating mercury with verdigris, common salt, vinegar, and water. ZINC. { <i>Brafs.</i> Commonly made by cementation with calamine. The larger the proportion of zinc, the paler, harder, and more brittle is the brafs. <i>Prince's metal, pinßbeck,</i> and other metals resembling gold. By employing zinc in substance in small proportions. The best pinßbeck about 1-4th of zinc. <i>Spelter.</i> A native substance, found in Cornwall, consisting of zinc and copper, and used as a folder.
SEMI-METALS.	ANTIMONY. By fusion. BISMUTH. A palish brittle mass. Somewhat resembling silver. ARSENIC. <i>White copper.</i> By pouring arsenic, fused with nitre, upon copper in fusion. If too large a proportion of arsenic is used, it makes the compound black and apt to tarnish. PLATINA. A white and hard compound, which does not tarnish so soon as pure copper, and admits of a fine polish. COBALT. White and brittle. NICKEL. White and brittle, and apt to tarnish.
ACIDS:	Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Ants, as above.
ALKALIS:	Fixed *, and Volatile, as above.
SULPHUR,	as above.
METALS:	Gold, Silver *, Lead *, Tin, and Copper, as above.
IRON.	ZINC. A white substance resembling silver. ANTIMONY. The magnetic quality of the iron is totally destroyed in this compound. BISMUTH. In a strong heat, this emitteth flames. ARSENIC. A whitish, hard, and brittle compound. By fusing with soap or tartar. *A metal resembling fine steel is made by fusing cast iron with a little arsenic and glass. PLATINA. With cast iron it forms a compound remarkably hard, somewhat ductile, and susceptible of a fine polish. COBALT. A compound remarkably ductile. By fusion in a moderate heat. NICKEL. A brittle mass.
VITRESCENT EARTHS.	A transparent glass. In general blackish; but sometimes yellow, green, or blue. The colour is influenced by the degree of heat as well as nature of the ingredients.
ACIDS:	Vitriolic, Nitrous, Muriatic, Vegetable *, of Urine, as above.
ALKALI:	Fixed *, as above.
SULPHUR,	as above.
MERCURY.	METALS: Gold, Silver *, Lead *, Tin, and Copper, as above. ZINC. An amalgum. Soft or hard, according to the proportions employed. ANTIMONY *. By melting the regulus, and pouring it upon boiling mercury. By frequently distilling from this amalgum, the mercury is rendered much more pure, and is then called <i>animated mercury</i> . BISMUTH. A silverizing for iron. By putting this amalgum upon iron, and evaporating the mercury. It has much the appearance of silver. PLATINA. The compound resulting from this mixture is not known. COBALT. By mixing first with nickel, and then adding mercury.
ACIDS:	Vitriolic, Nitrous, Muriatic, Vegetable, of Urine, of Amber, of Ants, as above.
OIL:	Expressed *, as above.
SULPHUR *,	as above.
ZINC.	METALS: Gold, Silver, Lead, Tin, Copper, and Iron, as above. MERCURY, as above. ANTIMONY. This mixture is applied to no particular use. ARSENIC. A black and friable mass. PLATINA. A hard substance. COBALT. The particular nature and properties of this mixt is not known.
ACIDS:	Vitriolic *, Nitrous, Vegetable *, and Urinous. With the phenomena, and by the means above described.
ALKALIS:	Fixed and Volatile, as above.
SULPHUR,	as above.
METALS:	Gold, Silver, Lead, Tin *, Copper, and Iron, as above.
ANTI-MONY.	MERCURY, and Zinc, as above. BISMUTH, A mass resembling regulus of antimony. ARSENIC. The nature and qualities of this mixt are not known. PLATINA. A hard mass. COBALT. Nature unknown. NICKEL. Ditto.
VITREOUS EARTHS.	A thin penetrating glass; which is a powerful flux of metals.
ACIDS:	Vitriolic, Nitrous, Muriatic, Vegetable, and urinous; with the phenomena, &c. above described.
ALKALIS:	Fixed *, and Volatile *, as above.
SULPHUR,	as above.
METALS:	Gold, Silver, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS.	MERCURY and ANTIMONY, as above. ARSENIC. Nature not known. PLATINA. This mixture changes its colour much on being exposed to the air. COBALT *. By mixing first with nickel or regulus of antimony, and then adding cobalt; but it cannot be united by itself. NICKEL. This mixt is not known.
VITREOUS MATTERS.	A yellow glass. The ore of bismuth affords with these a blue glass; but this is probably owing to some mixture of cobalt with it.
ACIDS:	Vitriolic, Muriatic *, Vegetable *, and Urinous; with the phenomena, &c. above mentioned.
ALKALIS:	Fixed, and Volatile; with the phenomena, and by the means mentioned above.
SULPHUR,	as above.
METALS:	Gold, Silver, Lead, Tin, Copper, and iron, as above.
SEMI-METALS.	ZINC, Antimony, and Bismuth, as above. PLATINA. COBALT. NICKEL. The phenomena attending these mixtures have not been as yet particularly observed.
VITREOUS MATTERS.	A glass which greatly promotes the fusion of other matters. The arsenic must first be prepared by dissolving and precipitating from alkalis.
ACIDS:	Muriatic *, with the phenomena, &c. mentioned above.
ALKALI:	Volatile, as above.
METALS:	Gold, Silver, Tin, Copper, and Iron, as above.
SEMI-METALS.	MERCURY, Zinc, Bismuth, and Arsenic, as above. COBALT. NICKEL. The phenomena attending these mixtures not yet observed.
ACIDS:	Vitriolic, Nitrous, Muriatic, and Urinous; with the phenomena, &c. as above described.
ALKALI:	Volatile, as above.
METALS:	Gold, Silver, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS.	MERCURY *, Zinc, Antimony, Bismuth *, Arsenic, and Platina, as above. NICKEL. The properties of this compound not known.
EARTHY.	CALX OF FLINT. { <i>Zaffre.</i> By mixing calcined cobalt with calx of flint, and moistening them with water, and pressing them close in wooden tubs. <i>Smalt.</i> By vitrifying these with the addition of a little potash.
ACIDS:	Nitrous, and Muriatic; with the phenomena, &c. as mentioned above.
ALKALI:	Volatile, as above.
SULPHUR,	as above.
METALS:	Gold, Lead, Tin, Copper, and Iron, as above.
SEMI-METALS:	Antimony, Bismuth, Arsenic, Platina, and Cobalt, as above.
ACIDS:	Vitriolic, Nitrous, Muriatic, and Vegetable; with the phenomena, and by the assistances above mentioned.
ALKALIS:	Fixed, as above.
ABSORBENT EARTHS.	EARTHY. { CRYSTALLINE. By this mixture they are both much easier melted into glass than by themselves, but not without the addition of some alkali. ARGILLACEOUS. This mixture easily runs into a glass without any addition. WATER. <i>Lime-water.</i> By solution. It is sometimes found flowing out of the earth in springs; and as it always quits the water when exposed to the air, it is there deposited on the banks of the streams, forming the stony incrustations called <i>petrifications</i> : And filtering through the pores of the earth, and dropping through the roofs of subterraneous caves, it forms the curious incrustations found hanging from the roof of such places; sometimes assuming forms stupendously magnificent. AIR. <i>Fixt Lime stone.</i> It is from the quality that quick-lime has of absorbing its air, and again with it refining its stony consistence, that it is fitted for a cement in building; and the great hardness of the cements in old buildings is owing to the air being more perfectly united with these than in newer works.
ACIDS:	Vitriolic *, and Nitrous *, with the phenomena, &c. as above mentioned.
ALKALI:	Fixed, as above.
METALS:	Lead, Tin, Copper, and Iron, as above.
SEMI-METALS:	Antimony, Bismuth, Arsenic, and Cobalt, as above.
ABSORBENT EARTHS:	as above.
ARGILLACEOUS EARTHS.	A mass running into glass in a moderate heat.
WATER.	Although this is not soluble in water by any operation that we are acquainted with, yet, from its crystalline form, it is probable that it has been once suspended; and certainly it is so at this day in those petrifying springs whose incrustations are of the crystalline sort.
ARGILLACEOUS EARTHS,	with Absorbent and Crystalline Earths, as above. With water it only unites into a paste of a mechanical nature.

### EXPLANATION OF THE TABLES.

It was imagined, that a systematic view of the several chemical bodies, arranged under distinct classes, would be of use to convey a clear idea of this subject to the mind, and serve to impress it better upon the memory of the reader; and with this view the first table was composed, the several parts of which are so plain as to admit of no explanation.

The same causes induced us to think, that a systematic view of the several compounds resulting from the mixture of these simple bodies would be agreeable to the public; and on that account the second table was compiled; in which we have followed the same general arrangement as in the first: Showing, in the first place, the several bodies with which the vitriolic acid can be combined; then proceeding to the nitrous acid, the muriatic, &c. through all the other classes, in the same order as in the foregoing table. In the first column, then, on the left hand, is placed a simple body, which can be united with some one or more individuals of each of these species which are put in the second column, and the particular substance of each species with which it can be united is put in the third column; after which is placed the name and properties of the compound, the operation by which they are united, &c. And in the enumeration of these bodies with which any one can be combined, they are placed in the same order as is generally observed; beginning with acids, and proceeding to alkalis, oils, sulphur, &c. through all the classes. An example of the manner of reading the table will make all this plain.

At the top of the first column, on the left hand, is placed the *Vitriolic Acid*, which can be combined with some particular kind or each of those species of bodies enumerated in the second column, included within the crochets opposite to it. By this it appears that it can be combined with acids, alkalis, oils, sulphur, alcohol, metals, semi-metals, earths, and water. The particular kinds of each class with which it can be united are placed in the third column; by which it appears, that of the class of acids it can be united with the nitrous acid, and with it form a mixture, the only property of which, that has been observed, is, that it readily inflames oils. It likewise unites with the muriatic and all other acids, as there mentioned. Under the class of alkalis, it appears that it can be united with the vegetable, fixt, and volatile alkalis. With the fixt of which it forms the substance called *vitriolated tartar*, and the two other substances there enumerated, by the operations there mentioned. With the volatile alkali it forms *Glauber's salt*; and with the volatile alkali, *fixed ammonia*, by the means there mentioned. All the other articles throughout the table are to be read in the same manner.

In the same way we proceed through the whole of the table, taking each simple chemical body in its order, and, placing it in the first column, then what others it can be united with. But it is to be observed, that as we advance in the table we put down only the names of those substances which have been

already examined; because under each of these the particular mixts formed by this union have been already described. Thus, looking along the first column till you come to *Fixt Alkali*, you find in the second column, at the top of the crochets belonging to this article, *Acids*, and, following it, *Vitriolic, Nitrous, Muriatic, &c.* with a reference to the foregoing parts of the table; and if you look back to the article *Vitriolic Acid*, under the article *Alkali* in the second column, you find both the vegetable and fixt, with the compounds resulting from this mixture, so that it was unnecessary to repeat it over again under the article *Alkali*. By the same means the union of this with the nitrous and other acids are found under each particular acid. And the same method is to be observed with regard to every reference to the end of the table.

We once proposed to have omitted mentioning any of these articles which had been already described, from which the references are made; but were induced to place them as in the table, because by means of these it is easy to see, at one view, all the bodies that any one particular body can be united with, whereas, without this, if any one had wanted to know this particular, he behoved to have turned to every article that preceded it. For example, if the article *Bismuth* was to be examined with this view; turn to it, in the first column near the end; at once you see with what particular acids, alkalis, sulphur, and metals, it can be joined with; whereas if these had been here omitted, it would have been necessary to have consulted every article preceding it before you could have known which it could, and which it could not be united with.

It is unnecessary to say much about the use that may be made of this table, as they are pretty obvious. The principal one is to show, at one view, what bodies any one can be united with, as in the example just now given. Again, if it was wanted to know if any one particular substance could unite with any other particularly specified, it is here at once seen. Let it be (*z. s.*) required to know if copper and zinc can be united; turn to the article *Copper* in the first column, and search among the semi-metals; you there find *Zinc*, and see that this compound forms *brass, prince's metal, and spelter*. And in the same way any other substance may be examined. If, on the other hand, by glancing along the compounds (which are here printed in italics) you meet with any particular substance whose composition you want to know, it is at once discovered. Thus for example, common nitre has caught your eye, of whose composition you would wish to be informed. By looking to the left hand, you find *z. s. table alkali* (which in the first table is shown to be the same with *Potash*); and by looking to the first column opposite to it, you find the *Nitrous Acid*, or *Az. Fixt.*, from which you at once are informed that it is composed of *Potash* and *Potash*.



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either of which if it fails, the whole business of *numbering* will be disturbed; and there will remain only the confused *idea* of *multitude*; but the *ideas* necessary to distinct numeration will not be attained to.

*Of infinity.*

THE *idea* signified by the name *infinity*, is best examined, by considering to *what* infinity is by the mind attributed, and then *how* it frames it. *Finite* and *infinite*, then, are looked upon as the modes of quantity; and attributed primarily to things that have parts, and are capable of increase or diminution by the *addition* or *subtraction* of any the least part. Such are the *ideas* of *space*, *duration*, and *number*.

When we apply this *idea* to the *Supreme Being*, we do it primarily, in respect of his duration and ubiquity; more figuratively, when to his *wisdom*, *power*, *goodness*, and other attributes, which are properly *inexhaustible* and *incomprehensible*: For when we call them infinite, we have no other *idea* of this infinity, but what carries with it some reflection on the *number* or the *extent* of the *acts* or *objects* of God's power and wisdom, which can never be supposed too great, or so many, that these attributes will not always surmount and exceed, though we multiply them in our thoughts with the infinity of *endless number*.

The next thing to be considered, is, *How we come* by the *idea* of infinity. Every one that has any *idea* of any stated lengths of space, as a *foot*, *yard*, &c. finds that he can repeat that *idea*, and join it to *another*, to a *third*, and so on without ever coming to an end of his additions. From this power of enlarging his *idea* of space, he takes the *idea* of infinite space, or *immensity*. By the same power of repeating the *idea* of any length of duration we have in our minds, with all the endless addition of number, we come by the *idea* of *eternity*.

If our *idea* of *infinity* be got by repeating without end our own *ideas*; why do we not attribute it to other *ideas*, as well as those of *space* and *duration*; since they may be as easily and as often repeated in our minds, as the other: Yet no body ever thinks of infinite *sweetness* or *whiteness*, though he can repeat the *idea* of *sweet* or *white* as frequently as those of *yard* or *day*. But those *ideas* that have parts, and are capable of increase by the addition of any parts, afford us, by their repetition, an *idea* of infinity; because with the endless repetition there is continued an enlargement, of which there is no end. But it is not so in other *ideas*: For if to the perfect *idea* I have of *white*, I add another of equal whiteness; it enlarges not my *idea* at all. Those *ideas* that consist not of parts, cannot be augmented to what proportion men please, nor be stretched beyond what they have received by their senses: But *space*, *duration*, and *number*, being capable of increase by repetition, leave in the mind an *idea* of an endless room for more; and so these *ideas* alone lead the mind towards the thought of infinity.

*Of the modes of thinking.*

WHEN the the mind turns its view inwards upon itself, *thinking* is the first *idea* that occurs: Wherein it observes a great variety of modifications; and thereof frames to

itself distinct *ideas*. Thus the perception annexed to any impression on the body made by an external object, is called *sensation*. When an *idea* recurs without the presence of the object, it is called *remembrance*: When sought after by the mind, and brought again in view, it is *recollection*: When held there long under attentive consideration, it is *contemplation*. When *ideas* float in the mind without regard or reflection, it is called in French *réverie*; our language has scarce a name for it: When the *ideas* are taken notice of, and, as it were, registered in the memory, it is *attention*: When the mind fixes its view on any one *idea*, and considers it on all sides, it is *intention* and *study*. *Sleep*, without dreaming, is rest from all these. And *dreaming* is the perception of *ideas* in the mind, not suggested by any external objects, or known occasions; nor under any choice or conduct of the understanding.

*Of the modes of pleasure and pain.*

PLEASURE and *pain* are simple *ideas*, which we receive both from sensation and reflection. There are thoughts of the mind, as well as sensations, accompanied with pleasure or pain. Their causes are termed *good* or *evil*. *Pleasure* and *pain*, and their causes *good* and *evil*, are the hinges upon which our passions turn; by reflecting on the various modifications or tempers of mind, and the internal sensations which pleasure and pain, good and evil, produce in us, we may thence form to ourselves the *ideas* of our passions. Thus by reflecting upon the thought we have of the delight which any thing is apt to produce in us, we have an *idea* we call *love*: And on the contrary, the thought of the pain which any thing present or absent produces in us, is what we call *hated*. *Desire* is that uneasiness which a man finds in himself upon the absence of any thing the present enjoyment of which carries the *idea* of delight with it. *Joy* is a delight of the mind arising from the present or assured approaching possession of a good. *Sorrow* is an uneasiness of the mind, upon the thought of a good lost, or the sense of a present evil. *Hope* is a pleasure in the mind, upon the thought of a probable future enjoyment of a thing which is apt to delight. *Fear* is an uneasiness of the mind, upon the thought of a future evil likely to befall us. *Anger* is a discomposure of mind, upon the receipt of injury, with a present purpose of revenge. *Despair* is the thought of the unattainableness of any good. *Envy* is an uneasiness of mind, caused by the consideration of a good we desire, obtained by one we think should not have had it before us.

It is to be considered, that in reference to the passions, the removal or lessening of a pain, is considered and operates as a pleasure; and the loss or diminishing of a pleasure, as a pain. And farther, that the passions in most persons operate on the body, and cause various changes in it; but these being not always sensible, do not make a necessary part of the *idea* of each passion.

*Of power.*

THE mind being every day informed by the senses of the alteration of those simple *ideas* it observes in things without, reflecting also on what passes within itself, and observing

observing a constant change of its *ideas*, sometimes by the impressions of outward objects upon the senses, and sometimes by the determination of its own choice; and concluding, from what it has so constantly observed to have been, that the like changes will for the future be made in the same things, by the same agents, and by the like ways, considers in one thing the possibility of having any of its simple *ideas* changed, and in another the possibility of making that change, and so comes by that *idea* which we call *power*. Thus we say *fire* has a power to *melt gold*, and make it fluid; and *gold* has a power to be *melted*.

Power thus considered, is twofold, *viz.* as able to make, or able to receive any change: the one may be called *active*, the other *passive power*. Of *passive power* all sensible things abundantly furnish us with *ideas*, whose sensible qualities and beings we find to be in a continual flux. Nor have we of *active power* fewer instances; since whatever change is observed, the mind must collect a power somewhere able to make that change. But yet, if we will consider it attentively, bodies by our senses do not afford us so clear and distinct an *idea* of *active power* as we have from reflection on the operations of our minds. For all power relating to action, and there being but two sorts of action, *viz.* *thinking* and *motion*, let us consider whence we have the clearest *ideas* of the powers which produce these actions.

Of *thinking*, body affords us no *idea* at all: It is only from reflection that we have that; neither have we from body any *idea* of the beginning of motion. A body at rest, affords us no *idea* of any *active power* to move; and when it is set in motion itself, that motion is rather a passion than an action in it. The *idea* of the beginning of motion, we have only by reflection on what passes in ourselves; where we find by experience, that barely by willing it, we can move the parts of our bodies which were before at rest.

We find in ourselves a power to begin or forbear, continue or end, several actions of our minds, and motions of our bodies, barely by a thought, or preference of the mind. This power which the mind has thus to order the consideration of any *idea*, or the forbearing to consider it; or to prefer the motion of any part of the body to its rest, and *vice versa*, in any particular instance, is that we call the *will*; the actual exercise of that power is that which we call *volition*, or *willing*. The forbearance or performance of that action, consequent to such order or command of the mind, is called *voluntary*; and whatsoever action is performed without such a thought of the mind, is called *involuntary*.

The power of perception is that we call the *understanding*. *Perception*, which we make the act of the understanding, is of three sorts: 1<sup>st</sup>, The perception of *ideas* in our minds. 2<sup>dly</sup>, The perception of the signification of signs. 3<sup>dly</sup>, The perception of the agreement or disagreement of any distinct *ideas*. These powers of the mind, *viz.* of perceiving and preferring, are usually called by another name; and the ordinary way of speaking is, that the understanding and will are two *faculties* of the mind.

From the consideration of the extent of the power of

the mind over the actions of the man, which every one finds in himself, arise the *ideas* of *liberty* and *necessity*: so far as a man has a power to think or not to think, to move or not to move, according to the preference or direction of his own mind, so far is a man free. Wherever any performance or forbearance are not equally in a man's power; where-ever doing, or not doing, will not equally follow upon the preference of his mind; there he is not *free*, though perhaps the action may be *voluntary*. So that the *idea* of *liberty*, is the *idea* of a power in any agent to do or forbear any action, according to the determination or thought of the mind whereby either of them is preferred to the other. Where either of them is not in the power of the agent to be produced by him, according to his volition, there he is not at liberty; that agent is under *necessity*. So that *liberty* cannot be where there is no *thought*, no *volition*, no *will*; but there may be thought, there may be will, there may be volition, where there is no *liberty*. Thus a *tennis ball*, whether in motion by the stroke of a racket, or lying still at rest, is not by any one taken to be a free agent. So a man striking himself or his friend by a convulsive motion of his arm, which it is not in his power by volition or the direction of his mind to stop or forbear; no body thinks he has in this *liberty*; every one pities him, as acting by *necessity* and *constraint*. Again, suppose a man be carried whilst fast asleep into a room, where is a person he longs to see, and be there locked fast in, beyond his power to get out; he awakes, and is glad to see himself in so desirable company; which he stays willingly in, that is, prefers his staying to going away. Is not this stay voluntary? no body will doubt it; and yet being locked fast in, he is not at liberty to stay; he has not freedom to be gone. So that *liberty* is not an *idea* belonging to volition or preferring, but to the person having the power of doing, or forbearing to do, according as the mind shall chuse or direct.

As it is in the motions of the body, so it is in the thoughts of our minds: where any one is such, that we have power to take it up, or lay it by, according to the preference of the mind, there we are at liberty. A waking man is not at liberty to think, or not to think, no more than he is at liberty whether his body shall touch any other or no: But whether he will remove his contemplation from one *idea* to another, is many times in his choice. And then he is, in respect of his *ideas*, as much at liberty, as he is in respect of bodies he rests on. He can at pleasure remove himself from one to another: but yet some *ideas* to the mind, like some motions to the body, are such, as in certain circumstances it cannot avoid, nor obtain their absence by the utmost effort it can use. Thus a man on the rack is not at liberty to lay by the *idea* of *pain*, and entertain other contemplations.

Where-ever thought is wholly wanting, or the power to act or forbear according to the direction of thought, there necessity takes place. This in an agent capable of volition, when the beginning or continuation of any action is contrary to the preference of his mind, is called *compulsion*; when the hindering or stopping any action is contrary to his volition, it is called *restraint*: Agents that have no thought, no volition at all, are in every thing necessary agents.

*Of mixed modes.*

Mixed modes are combinations of *simple ideas* of different kinds. The mind being once furnished with *simple ideas*, can put them together in several compositions, without examining whether they exist so together in nature. And hence it is, that these ideas are called *notions*, as if they had their original and constant existence more in the thoughts of men, than in the reality of things: and to form such ideas, it sufficed that the mind put the parts of them together, and that they were consistent in the understanding, without considering whether they had any real being. There are three ways whereby we get these complex ideas of *mixed modes*.

1<sup>st</sup>, By *experience*, and observation of things themselves: Thus by seeing two men wrestle, we get the *idea* of wrestling.

2<sup>dly</sup>, By *invention*, or voluntary putting together of several *simple ideas* in our own minds: So he that first invented *printing*, had an *idea* of it first in his mind before it ever existed.

3<sup>dly</sup>, By *explaining* the names of actions we never saw, or nations we cannot see; and by enumerating all those *ideas* which go to the making them up. Thus the mixed mode, which the word *lie* stands for, is made up of these *simple ideas*: 1<sup>st</sup>, *Articulate sounds*. 2<sup>dly</sup>, *Certain ideas in the mind of the speaker*. 3<sup>dly</sup>, *Those words, the signs of these ideas*. 4<sup>thly</sup>, *Those signs put together*, by affirmation or negation, otherwise than the *ideas* they stand for are in the mind of the speaker. Since languages are made, *complex ideas* are usually got by the explication of those terms that stand for them: for since they consist of *simple ideas* combined, they may, by words standing for those *simple ideas*, be represented to the mind of one who understands those words, though that combination of *simple ideas* was never offered to his mind by the real existence of things.

Mixed modes have their *unity* from an act of the mind, combining those several *simple ideas* together, and considering them as one complex one: the mark of this union is one *name* given to that combination. Men seldom reckon any number of *ideas* to make one complex one: but such collections as there be names for. Thus the *killing of an old man*, is as fit to be united into one *complex idea*, as that of *a father*; yet there being no name for it, it is not taken for a particular *complex idea*, nor a distinct species of action from that of killing any other man.

Those collections of *ideas* have names generally affixed, which are of frequent use in conversation: in which cases men endeavour to communicate their thoughts to one another with all possible dispatch. Those others, which they have seldom occasion to mention, they tie not together, nor give them names.

This gives the reason, why there are words in every language, which cannot be rendered by any one single word of another. For the fashions and customs of one nation make several combinations of *ideas* familiar in one, which another had never any occasion to make. Such were *Θεσπαισμός* among the Greeks, *proscriptio* among the Romans. This also occasions the *constant change* of

languages; because the change of custom and opinions brings with it new combinations of *ideas*, which, to avoid long descriptions, have new names annexed to them, and so they become *new species* of *mixed modes*.

Of all our *simple ideas*, those that have had most *mixed modes* made out of them, are *thinking*, and *motion*; which comprehend in them all action; and *power*, from whence these actions are conceived to flow. For actions being the great business of mankind, it is no wonder, if the several modes of thinking and motion should be taken notice of, the *ideas* of them observed and laid up in memory, and have names assigned them. For without such *complex ideas* with names to them, men could not easily hold any communication about them. Of this kind are the modes of actions distinguished by their *causes*, *means*, *objects*, *ends*, *instruments*, *time*, *place*, and other circumstances; as also of the powers fitted for those actions: thus *boldness* is the power to do or speak what we intend, without fear or disorder; which power of doing any thing, when it has been acquired by the frequent doing the same thing, is that *idea* we call *habit*; when forward, and ready upon every occasion, to break into action, we call it *disposition*: thus *testiness* is a disposition or aptness to be angry.

*Power* being the source of all action, the substances wherein these powers are, when they exert this power, are called *causes*; and the substances thereupon produced, or the *simple ideas* introduced into any subject, *effects*. The efficacy whereby the new substance or *idea* is produced, is called, in the subject exerting that power, *action*; in the subject, wherein any *simple idea* is changed, or produced, *passion*: Which efficacy, in *intellectual agents*, we can conceive to be nothing else but modes of thinking and willing; in *corporeal agents*, nothing else but modifications of motion.

*Of our complex ideas of substances.*

THE mind observing several *simple ideas* to go constantly together, which being presumed to belong to one thing, are called, so united in one subject, by one name, which we are apt afterward to talk of and consider as one *simple idea*, which indeed is a complication of many *ideas* together. We imagine not these *simple ideas* to subsist by themselves; but suppose some *substratum* wherein they subsist, which we call *substance*. The *idea* of pure substance is nothing but the supposed (but unknown) support of these qualities, which are capable of producing *simple ideas* in us.

The *ideas* of *particular circumstances* are composed out of this obscure and general *idea* of substance, together with such combinations of *simple ideas* as are observed to exist together, and supposed to flow from the internal constitution and unknown essence of that substance. Thus we come by the *ideas* of *man*, *horse*, *gold*, &c. Thus the sensible qualities of *iron*, or a *diamond*, make the *complex ideas* of those substances, which a smith or a jeweller commonly knows better than a philosopher.

The same happens concerning the operations of the mind, *viz.* *thinking*, *reasoning*, &c. which we concluding not to subsist by themselves, nor apprehending how they can belong to body, or be produced by it, we think

them

them the actions of some other substance, which we call *spirit*; of whose substance or nature we have as clear a notion as of that of body; the one being but the supposed *substratum* of the simple *ideas* we have from without, as the other of those operations which we experiment in ourselves within: So that the *idea* of corporeal substance in matter, is as remote from our conceptions as that of *spiritual substance*.

Hence we may conclude, that he has the perfectest *idea* of any particular substance, who has collected most of those simple *ideas* which do exist in it; among which we are to reckon its *active powers* and *passive capacities*, though not strictly *simple ideas*.

*Secondary qualities*, for the most part, serve to distinguish substances. For our senses fail us in the discovery of the *bulk*, *figure*, *texture*, &c. of the minute parts of bodies, on which their real constitutions and differences depend; and secondary qualities are nothing but powers, with relation to our senses. The *ideas* that make our complex ones of corporeal substances, are of three sorts: *First*, The *ideas* of primary qualities of things, which are discovered by our senses; such are *bulk*, *figure*, *motion*, &c. *Secondly*, The sensib'le secondary qualities; which are nothing but powers to produce several *ideas* in us by our senses. *Thirdly*, The aptness we consider in any substance, to cause or receive such alterations of primary qualities, as that the substance so altered should produce in us different *ideas* from what it did before; and they are called *active* and *passive powers*. All which, as far as we have any notice or notion of them, terminate in *simple ideas*.

Had we senses acute enough to discern the minute particles of bodies, it is not to be doubted, but they would produce quite different *ideas* in us; as we find in viewing things with *microscopes*. Such bodies as to our naked eyes are coloured and opaque, will through *microscopes* appear pellucid. *Blood* to the naked eye appears all red; but by a good *microscope* we see only some red globules swimming in a transparent liquor.

Besides these complex *ideas* we have of material substances; by the simple *ideas* taken from the operations of our own minds, which we experiment in ourselves, as *thinking*, *understanding*, *willing*, *knowing*, &c. co-existing in the same substance, we are able to frame the complex *idea* of a *spirit*. And this *idea* of an *immaterial substance*, is as clear as that we have of a *material*. By joining these with substance, of which we have no distinct *idea*, we have the *idea* of a *spirit*: And by putting together the ideas of coherent solid parts, and power of being moved, joined with substance, of which likewise we have no positive *idea*, we have the *idea* of *matter*. The one is as clear and distinct as the other. The substance of *spirit* is unknown to us; and so is the substance of *body* equally unknown to us. Two primary qualities or properties of body, *viz.* *solid coherent parts*, and *impulse*, we have distinct clear *ideas* of: So likewise have we of two primary qualities or properties of spirit, *viz.* *thinking*, and a *power of action*. We have also clear and distinct *ideas* of several qualities inherent in bodies, which are but the various modifications of the extension of cohering solid parts and their motion. We have likewise

the *ideas* of the several modes of thinking, *viz.* Believing, doubting, hoping, fearing, &c. as also of willing and moving the body consequent to it.

#### Of relation.

THERE is another set of *ideas* which the mind gets from the comparing of one thing with another. When the mind so considers one thing, that it does as it were bring it to and set it by another, and carry its view from one to the other, this is *relation* or *respect*; and the denominations given to things intimating that respect, are what we call *relatives*, and the things so brought together *related*. Thus when I call CAJUS, *husband*, or *whiter*, I intimate some other person, or thing, in both cases, with which I compare him. Any of our *ideas* may be the foundation of relation.

Where languages have failed to give correlativenames, there the relation is not so easily taken notice of: As in *concubine*, which is a relative name as well as *wife*.

The *ideas* of relation may be same in those men who have far different *ideas* of the things that are related. Thus those who have different *ideas* of *man*, may agree in that of *father*.

There is no *idea* of any kind, which is not capable of an almost infinite number of considerations, in reference to other things; and therefore this makes no small part of mens words and thoughts. Thus one single man may at once sustain the relations of *father*, *brother*, *son*, *husband*, *friend*, *subject*, *general*, *European*, *Englishman*, *Islander*, *master*, *servant*, *bigger*, *less*, &c. to an almost infinite number; he being capable of as many relations, as there may be occasions of comparing him to other things in any manner of agreement, disagreement, or respect whatsoever.

#### Of cause and effect, and other relations.

THE *ideas* of *cause* and *effect* we get from our observation of the vicissitude of things, while we perceive some qualities or substances begin to exist, and that they receive their existence from the due application and operation of other beings: That which produces, is the *cause*; that which is produced, the *effect*. Thus *fluidity* in wax is the effect of a certain degree of heat, which we observe to be constantly produced by the application of such heat.

We distinguish the originals of things into two sorts.

First, When the thing is wholly made new, so that no part thereof did ever exist before, as when a new particle of matter doth begin to exist which had before no being, it is called *creation*.

Secondly, When a thing is made up of particles which did all of them before exist, but the thing so constituted of pre-existing particles, which all together make up such a collection of simple *ideas*, had not any existence before, as this *man*, this *egg*, this *rose*, &c. this, when referred to a substance produced in the ordinary course of nature by an internal principle, but set on work by some external agent, and working by insensible ways which we perceive not, is called *generation*: When the cause is extrinsic, and the effect produced by a sensible separation, or juxtaposition of discernible parts, we call it *making* and such are all artificial things. When any simple *idea* is produced

duced, which was not in that subject before, we call it *alteration*.

The denominations of things taken from *time*, are for the most part only relations. Thus when it is said that Queen *Elizabeth* lived sixty-nine, and reigned forty-five years, no more is meant, than that the duration of her existence was equal to sixty-nine, and of her government to forty-five annual revolutions of the sun.

*Young* and *old*, and other words of time, that are thought to stand for positive *ideas*, are indeed relative; and intimate a relation to a certain length of duration, whereof we have the *idea* in our minds. Thus we call a man young or old, that has lived little or much of that time that men usually attain to. This is evident from our application of these names to other things; for a *man* is called young at twenty, but a *horse* old, &c. The sun and stars we call not old at all, because we know not what period God has set to that sort of beings.

There are other *ideas*, that are truly *relative*, which we signify by names that are thought *positive* and *absolute*; such as *great* and *little*, *strong* and *weak*. The things thus denominated, are referred to some standards, with which we compare them. Thus we call an *apple* *great*, that is bigger than the ordinary sort of those we have been used to; and a man *weak*, that has not so much strength or power to move, as men usually have.

#### Of identity and diversity.

ANOTHER occasion the mind takes of comparing, is the very *being of things*. When considering a thing as existing at any certain time, or place, and comparing it with itself as existing at any other time, &c. it forms the *ideas of identity and diversity*. When we see any thing in any certain time and place, we are sure it is that very thing, and can be no other, how like soever it may be in all other respects.

We conceiving it impossible that two things of the same kind should exist together in the same place, we conclude, that whatever exists any where at the same time, excludes all of the same kind, and is there itself alone. When therefore we demand whether any thing be the *same*, or no, it refers always to something that existed such a time, in such a place, which it was certain at that instant was the same with itself and no other.

We have *ideas* of three sorts of substances: 1st, Of *God*; 2dly, *Finite intelligences*; 3dly, *Bodies*.

*First*, God being eternal, unalterable, and every where, concerning his *identity* there can be no doubt.

*Secondly*, Finite spirits having had their determinate time and place of beginning to exist, the relation to that time and place will always determine to each its *identity*, as long as it exists.

*Thirdly*, The same will hold of every particle of matter to which no addition or subtraction is made. These three exclude not one another out of the same place, yet each exclude those of the same kind out of the same place.

The identity and diversity of *modes* and *relations* are determined after the same manner that substances are; only the actions of finite beings, as *motion* and *thought*, consisting in succession, they cannot exist in different times and places as permanent beings: for no motion or thought,

considered as at different times, can be the same, each part thereof having a different beginning of existence.

From whence it is plain, that existence itself is the *principium individuationis*, which determinates a being to a particular time and place incommunicable to two beings of the same kind. Thus, suppose an *atom* existing in a determined time and place; it is evident that, considered in any instant, it is the same with itself, and will be so as long as its existence continues. The same may be said of two, or more, or any number of particles, whilst they continue together. The *mass* will be the same, however jumbled: but if one atom be taken away, it is not the same mass.

In *vegetables*, the identity depends not on the same mass, and is not applied to the same thing. The reason of this, is the difference between an animate body and mass of matter; *this* being only the cohesion of particles anyhow united; *the other*, such a disposition, an organization of parts, as is fit to receive and distribute nourishment, so as to continue and frame the wood, bark, leaves, &c. (of an *oak*, for instance) in which consists the vegetable life. That therefore which has such an organization of parts partaking of one common life, continues to be the same *plant*, though that life be communicated to new particles of matter, vitally united to the living plant. The case is not so much different in *brutes*, but that any one may hence see what makes an *animal*, and continues it the *same*.

The identity of the *same man* likewise consists in a participation of the same continued life in succeeding particles of matter vitally united to the same organized body.

To understand *identity* aright, we must consider what *idea* the word it is applied to stands for; it being one thing to be the *same substance*, another the *same man*, and a third the *same person*.

An *animal* is a living organized body; and the same animal is the same continued life communicated to different particles of matter, as they happen successively to be united to that organized living body; and our notion of *man* is but of a particular sort of animal.

*Person* stands for an intelligent being, that reasons and reflects, and can consider itself the same thing in different times and places; which it doth by that *consciousness* that is inseparable from thinking. By this every one is to himself what he calls *self*; without considering whether that *self* be continued in the same or divers substances. In this consists *personal identity*, or the sameness of a rational being; and so far as this consciousness extends backward to any past action or thought, so far reaches the identity of that person. It is the same *self* now, it was then: And it is by the same *self*, with this present one that now reflects on it, that that action was done.

*Self* is that conscious thinking thing, whatever substance it matters not, which is conscious of pleasure or pain, capable of happiness or misery; and so is concerned for itself as far as that consciousness extends. That with which the consciousness of this present thinking thing can join itself, makes the same person, and is one self with it; and so attributes to itself and owns all the actions of that thing as its own, as far as that consciousness reaches.

This *personal identity* is the subject of reward and punishment, being that by which every one is concerned for himself. If the *consciousness* went along with the little finger, when that was cut off, it would be the same self that was just before concerned for the whole body.

If the same *Socrates*, waking and sleeping, did not partake of the same consciousness, they would not be the same person. *Socrates* waking, could not be in justice accountable for what *Socrates* sleeping did, no more than one *twin* for what his brother *twin* did because their outsides were so like that they could not be distinguished.

But suppose I wholly lose the memory of some parts of my life, beyond a possibility of retrieving them, so that I shall never be conscious of them again: Am I not the same person that did those actions, though I have now forgot them? I answer, that we must here take notice what the word *I* is applied to, which in this case is the man only: And the same man being presumed to be the same person, *I* is easily here supposed to stand also for the same person. But if it be possible for the same man to have distinct incommunicable consciousness at different times, it is past doubt the same man would, at different times, make different persons. Which we see is the sense of mankind in the solemnest declaration of their opinions, human laws not punishing the mad man for the sober man's actions, nor the sober man for what the mad man did; thereby making them two persons. Thus we say in *English*, such a one is *not himself*, or is *besides himself*; in which phrases it is insinuated, that *self* is changed, and the *self-same person* is no longer in that man.

But is not a man drunk or sober the same person? Why else is he punished for the same fact he commits when drunk, though he be never afterwards conscious of it? Just as much the same person, as a man that walks and does other things in his sleep is the same person, and is as answerable for any mischief he shall do in it. Human laws punish both with a justice suitable to their way of knowledge: Because in these cases they cannot distinguish certainly what is real, and what is counterfeit. And so the ignorance in drunkenness or sleep, is not admitted as a plea: For though punishment be annexed to personality, and personality to consciousness; and the drunkard, perhaps, is not conscious of what he did; yet human judicatures justly punish him, because the fact is proved against him, but want of consciousness cannot be proved for him.

To conclude: Whatever substance begins to exist, it must during its existence be the same. Whatever compositions of substances begin to exist, during the union of those substances, the concrete must be the same. Whatsoever mode begins to exist, during its existence it is the same. And so if the composition be of distinct substances, and different modes, the same rule holds.

#### *Of other relations.*

ALL simple ideas, wherein are parts or degrees, afford an occasion of comparing the subjects wherein they are to one another, in respect of those simple ideas. As

*whiter, sweeter, more, less, &c.* These depending on the equality and excess of the same simple ideas, in several subjects, may be called *proportional relations*.

Another occasion of comparing things is taken from the circumstances of their origin, as *father, son, brother, &c.* These may be called *natural relations*.

Sometimes the foundation of considering things, is some act whereby any one comes by a moral right, power, or obligation to do something: Such are *general, captain, burgher*; these are *instituted* and *voluntary relations*, and may be distinguished from the *natural*, in that they are alterable and separable from the persons to whom they sometimes belonged, though neither of the substances so related be destroyed. But natural relations are not alterable, but are as lasting as their subjects.

Another relation is the conformity or disagreement of mens voluntary actions to a rule to which they are referred, and by which they are judged off: These may be called *moral relations*. It is this conformity or disagreement of our actions to some law (whereby good or evil is drawn on us from the will and power of the law-maker, and is what we call *reward* or *punishment*) that renders our actions morally good or evil.

Of these moral rules or laws, there seem to be three sorts, with their different enforcements: first, *The divine law*; secondly, *Civil law*; thirdly, *The law of opinion or reputation*. By their relation to the first, our actions are either *sin* or *duties*; to the second, *criminal* or *innocent*; to the third, *virtues* or *vices*.

First, *The divine law*, is that law which God has set to the actions of men, whether promulgated to them by the light of nature, or the voice of revelation.

That God has given a law to mankind, seems undeniable; since he has, first, A right to do it; we are his creatures. Secondly, Goodness and wisdom, to direct our actions to what is best. Thirdly, Power to enforce it by reward, and punishment: of infinite weight and duration. This is the only true touch-stone of moral rectitude; and by which men judge of the most considerable moral good or evil of their actions; that is, whether, as duties or sins, they are like to procure to them happiness or misery from the hands of the Almighty.

Secondly, *The civil law* is the rule set by the commonwealth to the actions of those that belong to it. This law nobody over-looks; the rewards and punishments being ready at hand to enforce it, extending to the protecting or taking away of the life, liberty, and estate of those who observe or disobey it.

Thirdly, *The law of opinion, or reputation*. *Virtue* and *vice* are names supposed every where to stand for actions in their own nature right and wrong. As far as they are really so applied, they so far are coincident with the divine law. But it is visible that these names in the particular instances of their application, through the several nations and societies of men, are constantly attributed only to such actions as in each country and society are in reputation or discredit. So that the measure of what is every where called and esteemed virtue and vice, is the approbation or dislike, praise or blame, which by a tacit consent establishes itself in the societies and tribes of men in the world;

world; whereby several actions come to find credit or disgrace amongst them, according to the judgment, maxims, or fashions of the place.

That this is so, appears hence: That though that passes for virtue in one place, which is elsewhere accounted vice, yet every where *virtue* and *praise*, *vice* and *blame*, go together: *Virtue* is every where that which is thought praise worthy; and nothing else but that which has the allowance of public esteem, is called *virtue*. These have so close an alliance, that they are often called by the same name.

It is true, virtue and vice do, in a great measure, every where correspond with the unchangeable rule of right and wrong, which the laws of God have established; because the observation of these laws visibly secures and advances the general good of mankind, and the neglect of them breeds mischief and confusion: And therefore men, without renouncing all sense and reason, and their own interest, could not generally mistake in placing their commendation and blame on that side that deserved it not.

They who think commendation and disgrace not sufficient motives to engage men to accommodate themselves to the opinions and rules of those with whom they converse, seem little skilled in the history of mankind; the greatest part whereof govern themselves chiefly by this *law of fashion*.

The penalties that attend the breach of God's laws are seldom seriously reflected on; and those that do reflect on them entertain thoughts of future reconciliation; and for the punishment due from the laws of the commonwealth, men flatter themselves with the hopes of impunity: But no man escapes censure and dislike, who offends against fashion; nor is there one of ten thousand stiff and insensible enough, to bear up under the constant dislike and condemnation of his own club.

*Morality* then is nothing but a relation to these laws or rules: And these rules being nothing but a collection of several simple *ideas*, the conformity thereto is but so ordering the action, that the simple *ideas* belonging to it may correspond to those which the law requires. By which we see, how moral beings and notions are founded on, and terminated in the simple *ideas* of sensation and reflection. For example; let us consider the complex *idea* signified by the word *murder*. First, from reflection, we have the *ideas* of *willing*, *considering*, *purposing*, *malice*, &c. also of *life*, *perception*, and *self-motion*. Secondly, from sensation, we have the *ideas* of *man*, and of some action whereby we put an end to that perception and motion in the man: All which simple *ideas* are comprehended in the word *murder*.

This collection of simple *ideas* being found to agree or disagree with the esteem of the country I have been bred in, and to be held worthy of praise or blame, I call the action *virtuous* or *vicious*. If I have the will of a supreme invisible Law maker for my rule; then as I suppose the action commanded or forbidden by God, I call it good or evil, *sin* or *duty*: If I compare it with the civil law of my country, I call it *lawful* or *unlawful*, a crime or no crime.

Moral actions may be considered two ways:

*First*, As they are in themselves a collection of simple *ideas*; in which sense, they are positive absolute *ideas*.

*Secondly*, As *good* or *bad*, or *indifferent*: In this respect they are *relative*, it being their conformity or disagreement with some rule that makes them so. We ought carefully to distinguish between the positive *idea* of the action, and the reference it has to a rule: Both which are commonly comprehended under one name, which often occasions confusion, and misleads the judgment.

Thus the taking from another what is his, without his consent, is properly called *stealing*: But that name being commonly understood to signify also the moral pravity of the action, men are apt to condemn whatever they hear called *stealing* as an ill action disagreeing with the rule of right. And yet the private taking away his sword from a madman, to prevent his doing mischief, though it be properly denominated *stealing*, as the name of such a *mixed mode*, yet when compared to the law of God, it is no sin or transgression, though the name *stealing* ordinarily carries such an intimation with it.

#### *Of real and fantastical ideas.*

Our *ideas*, in reference to things from whence they are taken, or which they may be supposed to represent, come under a *threefold* distinction; and are, first, either *real* or *fantastical*; secondly, *adequate*, or *inadequate*; thirdly, *true* or *false*.

*Real ideas*, are such as have a foundation in nature, such as have a conformity with the real being and existence of things, or with their archetypes.

*Fantastical* are such as have no foundation in nature, nor any conformity with that reality of being to which they are referred as to their archetypes. By examining the several sorts of *ideas* we shall find, that, first our *simple ideas* are all real; not that they are images or representations of what does exist, but as they are the certain effects of powers in things without us, ordained by our Maker to produce in us such sensations: They are *real ideas* in us, whereby we distinguish the qualities that are really in things themselves.

Their reality lies in the steady correspondence they have with the distinct constitutions of real beings. But whether they answer to those constitutions as to *causes* or *patterns*, it matters not; it suffices, that they are constantly produced by them.

*Complex ideas* being arbitrary combinations of *simple ideas* put together, and united under one general name, in forming of which the mind uses its liberty, we must inquire which of these are real, and which imaginary combinations.

*First*, Mixed modes and relations having no other reality than what they have in the minds of men, nothing else is required to make them real, but a possibility of existing conformable to them. These *ideas* being themselves *archetypes*, cannot differ from their *archetypes*, and so cannot be chimerical; unless any one will jumble together in them inconsistent *ideas*. Those indeed that have names assigned them in any language, must have a conformity to the ordinary signification of the name that is given

given them, that they may not be thought fantastical.

*Secondly*, Our complex *ideas* of substances being made, in reference to things existing without us, whose representations they are thought are no farther real, than as they are such combinations of *simple ideas* as are really united, and co-exist in things without us: those are fantastical which are made up of several *ideas* that never were found united, as *Centaur*, &c.

*Of ideas adequate or inadequate.*

REAL *ideas* are either *adequate* or *inadequate*. First, *adequate*; which perfectly represent those archetypes which the mind supposes them taken from, and which it makes them to stand for. *Secondly*, *Inadequate*; which are such as do but partially or incompletely represent those archetypes to which they are referred. Whence it appears,

*First*, That all our *simple ideas* are *adequate*; for they being but the effects of certain powers in things fitted and ordained by God to produce such sensations in us, they cannot but be correspondent and adequate to such powers, and we are sure they agree to the reality of things.

*Secondly*, Our complex *ideas of modes* being voluntary collections of *simple ideas*, which the mind puts together without reference to any real archetypes, cannot but be *adequate ideas*. They are referred to no other pattern, nor made by any original, but the good-liking and will of him that makes the combination. If indeed one would confirm his *ideas* to those which are formed by another person, they may be wrong or *inadequate*, because they agree not to that which the mind designs to be their archetype and pattern; in which respect only any *ideas of modes* can be wrong, imperfect, or inadequate.

*Thirdly*, Our *ideas of substances* have in the mind a double reference: *First*, They are sometimes referred to a supposed real essence, of each species of things; *secondly*, They are designed for representations in the mind, of things that do exist, by *ideas* discoverable in them: In both which respects they are *inadequate*.

*First*, If the names of substances stand for things, as supposed to have certain real essences, whereby they are of this or that species, of which real essences men are wholly ignorant; it follows, that the *ideas* they have in their minds, being referred to real essences as *archetypes* which are unknown, they must be so far from being adequate, that they cannot be supposed to be any representation of them at all. Our complex *ideas of substances* are nothing but certain collections of *simple ideas* that have been observed or supposed constantly to exist together. But such a complex *idea* cannot be the real essence of any substance: For then the properties we discover in it would be deducible from it, and their necessary connection with it be known; as all the properties of a *triangle* depend on and are deducible from the complex *idea of three lines including a space*: But it is certain, that in our complex *ideas of substances* are not contained such *ideas* on which all other qualities that are to be found in them depend.

*Secondly*, Those that take their *ideas of substances* from their sensible qualities, cannot form adequate *ideas*

of them: Because their qualities and powers are so various, that no man's complex *idea* can contain them all. Most of our *simple ideas*, whereof our complex ones of substances do consist, are powers, which being relations to other substances, we cannot be sure we know all the powers, till we have tried what changes they are fitted to give and receive from other substances in their several ways of application; which being not possible to be tried upon one body, much less upon all, it is impossible we should have adequate *ideas* of any substance made of a collection of all its properties.

*Of true and false ideas.*

TRUTH and *falsehood*, in propriety of speech, belong only to propositions; and when *ideas* are termed *true* or *false*, there is some secret or tacit proposition which is the foundation of that denomination. Our *ideas* being nothing but *appearances*, or *perceptions* in the mind, can, in strictness of speech, no more be said to be true or false, than single names of things can be said to be true or false. The *idea of Centaur* has no more falsehood in it when it appears in our minds, than the name *Centaur* when it is pronounced or writ on paper. For truth or falsehood lying always in some affirmation or negation, our *ideas* are not capable, any of them, of being false, till the mind passes some judgment on them, that is, affirms or denies something of them. In a *metaphysical* sense they may be said to be true, that is, to be really such as they exist; though in things called true, even in that sense, there is perhaps a secret reference to our *ideas*, looked upon as the standards of that truth; which amounts to a *mental proposition*.

When the mind refers any of its *ideas* to any thing extraneous to it, they are then capable of being true or false: because in such a reference, the mind makes a tacit supposition of their conformity to that thing; which supposition, as it is true or false, so the *ideas* themselves come to be denominated. This happens in these cases:

1<sup>st</sup>, When the mind supposes its *idea* conformable to that in other mens minds, called by the same name, such as that of *justice*, *virtue*, &c.

2<sup>dly</sup>, When the mind supposes any *idea* conformable to some real existence. Thus, that of *Man* is true, that of *Centaur* false; the one having a conformity to what has really existed, the other not.

3<sup>dly</sup>, When the mind refers any of its *ideas* to that real constitution and essence of any thing whereon all its properties depend: and thus the greatest part, if not all our *ideas of substances* are false.

As to the *first*, when we judge of our *ideas* by their conformity to those of other men, they may be any of them false: but *simple ideas* are least liable to be so mistaken. We seldom mistake green for blue, or bitter for sweet; much less do we confound the names belonging to different senses, and call a *colour* by the name of a *taste*. Complex *ideas* are much more liable to falsehood in this particular; and those of mixed modes more than substances: because in substances, their sensible qualities serve, for the most part, to distinguish them clearly; but in mixed modes we are more uncertain, and we may call that *justice* which ought to be called by another name. The

reason

reason of this is, that the abstract *ideas* of mixed modes being mens voluntary combinations of such a precise collection of simple *ideas*, we have nothing else to refer our *ideas* of mixed modes as standards to, but the *ideas* of those who are thought to use names in their proper significations: and so as our *ideas* conform or differ from them, they pass for true or false.

As to the *second*, When we refer our *ideas* to the real existence of things, none can be termed false but our complex *ideas* of substances: for our simple *ideas* being nothing but perceptions in us answerable to certain powers in external objects, their truth consists in nothing but such appearances as are produced in us suitable to those powers: neither do they become liable to the imputation of falsehood, whether we judge these *ideas* to be in the things themselves, or no: for God having set them as marks of distinguishing things, that we may be able to discern one thing from another, and thereby chuse them as we have occasion, it alters not the nature of our simple *ideas*, whether we think the *idea* of *blue* (for instance) to be in the violet itself, or in the mind only: and it is equally from that appearance to be denominated *blue*, whether it be that real colour, or only a peculiar texture in it, that causes in us that *idea*; since the name *blue* notes properly nothing but that mark of distinction that is in a violet, discernible only by our eyes, whatever it consists in.

Neither would our simple *ideas* be false, if by the different structure of our organs it were so ordered, that the same object should produce in several mens minds different *ideas*: for this could never be known, since objects would operate constantly after the same manner. It is most probable, nevertheless, that the *ideas* produced by the same objects in different mens minds, are very near and undiscernibly like. Names of simple *ideas* may be misapplied; as a man, ignorant in the *English* tongue, may call *purple*, *scarlet*: but this makes no falsehood in the *idea*.

Complex *ideas* of modes cannot be false, in reference to the essence of any thing really existing; because they have no reference to any pattern existing, or made by nature.

Our complex *ideas* of substances, being all referred to patterns in things themselves, may be false. They are so, *1<sup>st</sup>*, When looked upon as representations of the unknown essences of things: *2<sup>dly</sup>*, When they put together simple *ideas* which in the real existence of things have no union; as in *centaur*. *3<sup>dly</sup>*, When from any collection of simple *ideas*, that do always exist together, there is separated, by a direct negation, any one simple *idea* which is constantly joined with them. Thus, if from extension, solidity, fixedness, malleableness, fusibility, &c. we remove the colour observed in *gold*: If this *idea* be only left out of the complex one of *gold*, it is to be looked on as an inadequate and imperfect, rather than a false one; since though it contains not all the simple *ideas* that are united in nature, yet it puts none together but what do really exist together.

Upon the whole, our *ideas*, as they are considered by the mind, either in reference to the proper signification of their names, or in reference to the reality of things, may more properly be called *right* or *wrong ideas*, according

as they agree or disagree to those patterns to which they are referred. The *ideas* that are in mens minds, simply considered, cannot be wrong, unless *complex ideas*, wherein inconsistent parts are jumbled together. All other *ideas* are in themselves right, and the knowledge about them right and true knowledge. But when we come to refer them to any patterns, or archetypes, then they are capable of being wrong, as far as they disagree with such archetypes.

#### *Of the association of ideas.*

SOME of our *ideas* have a natural correspondence and connection one with another: It is the office and excellency of our reason to trace these, and hold them together in that union and correspondence which is founded in their peculiar beings. Besides this, there is another connection of *ideas* wholly owing to chance or custom: *Ideas* that in themselves are not at all of kin, come to be so united in some mens minds, that it is very hard to separate them; they always keep company, and the one no sooner comes into the understanding, but its associate appears with it; and if they are more than two, the whole gang always inseparably shew themselves together. This strong combination of *ideas*, not allied by nature, the mind makes in itself either voluntarily, or by chance: And hence it comes in different men to be very different, according to their different *inclinations*, *educations*, *interests*, &c. Custom settles habits of thinking in the understanding, as well as of determining in the will, and of motions in the body; all which seem to be but trains of motion in the animal spirits, which, once set a-going, continue on in the same steps they have been used to; which by often treading are worn into a smooth path, and the motion in it becomes easy, and, as it were, natural. As far as we can comprehend thinking, thus *ideas* seem to be produced in our minds; or if they are not, this may serve to explain their following one another in an habitual train, when once they are put into that tract, as well as it does to explain such motions of the body.

This connection in our minds of *ideas*, in themselves loose and independent one of another, is of so great force to set us awry in our actions, as well moral as natural, passions, reasonings, and notions themselves, that perhaps there is not any one thing that deserves more to be looked after. Thus the *ideas* of *goblins* and *sprights* have really no more to do with darkness than light; yet let but a foolish maid inculcate these often on the mind of a child, and raise them there together, possibly he shall never be able to separate them again so long as he lives, but darkness shall ever afterwards bring with it those frightful *ideas*. A man has suffered pain or sickness in any place; he saw his friend die in such a room; though these have in nature nothing to do one with another, yet when the *idea* of the *place* occurs to his mind, it brings that of the pain and displeasure with it; he confounds him in his mind, and can as little bear the one as the other.

*Intellectual habits* and defects this way contracted, are not less frequent and powerful, though less observed. Let the *ideas* of *being* and *matter* be strongly joined either by education or much thought, whilst these are still combined in the mind, what notions, what reasonings will

there be about separate spirits? Let custom from the very childhood have joined figure and shape to the *idea* of God, and what absurdities will that mind be liable to about the Deity? Let the *idea* of *infallibility* be joined to any person, and these two constantly together possess the mind; and then one body in two places at once shall be swallowed for a certain truth, whenever that imagined infallible person dictates, and demands assent without inquiry.

Some such wrong combinations of *ideas* will be found to establish the irreconcilable opposition between different sects of philosophy and religion: for we cannot imagine every one of their followers to impose wilfully on himself, and knowingly refuse truth offered by plain reason. Interest, though it does a great deal in the case, yet cannot be thought to work whole societies of men to so universal a perverseness, as that every one of them should knowingly maintain falsehood; some at least must be allowed to do what all pretend to, *i. e.* to pursue truth sincerely. That therefore which captivates their reasons, and leads men of sincerity blindfold from common sense, will, when examined, be found to be what we are speaking of: some independent *ideas*, are by education, custom, and the constant din of their party, so coupled in their minds, that they always appear there together; and they can no more separate them in their thoughts, than if they were but one *idea*; and they operate as if they were so. This gives sense to jargon, demonstration to absurdities, and consistency to nonsense, and is the foundation of the greatest errors in the world. The confusion of two different *ideas*, which a customary connection of them in their minds hath to them in effect made but one, cannot but fill mens heads with false views, and their reasonings with false consequences.

#### *Of knowledge in general.*

SINCE the mind, in all its thoughts and reasonings, has no other immediate object but its own *ideas*, which alone it does or can contemplate, it is evident that our knowledge is only conversant about them. *Knowledge* then seems to be nothing but the perception of the connection and agreement, or disagreement and repugnancy of any of our *ideas*: where this perception is, there is *knowledge*; and where it is not, there, though we fancy, guess, or believe, yet we always come short of *knowledge*. When we know that *white* is not *black*, what do we but perceive that these two *ideas* do not agree? Or that the three angles of a *triangle*, are equal to two right ones; what do we more but perceive that equality to two right ones does necessarily agree to, and is inseparable from the three angles of a triangle? But to understand a little more distinctly wherein this agreement or disagreement consists, we may reduce it all to these *four sorts*: 1st. *Identity* or *diversity*; 2dly. *Relation*; 3dly. *Co-existence*; 4thly. *Real existence*.

1. *Identity* or *diversity*. It is the first act of the mind, to perceive its *ideas*; and so far as it perceives them, to know each what it is, and thereby to perceive their difference, that is, the one not to be the other: by this the mind clearly perceives each *idea* to agree with itself, and to be what it is; and all distinct

*ideas* to disagree. This it does without any pains or deduction, by its natural power of perception and distinction. This is what men of art have reduced to those general rules, *viz. what is, is*; and, *it is impossible for the same thing to be and not to be*. But no *maxim* can make a man know it clearer, that *round* is not *square*, than the bare perception of those two *ideas*, which the mind at first sight perceives to disagree.

2. The next sort of agreement or disagreement the mind perceives in any of its *ideas*, may be called *relative*, and is nothing but the perception of the relation between any two *ideas* of what kind soever; that is, their agreement or disagreement one with another in several ways the mind takes of comparing them.

3. The third sort of agreement or disagreement to be found in our *ideas*, is, *co-existence* or *non-co-existence* in the same subject; and this belongs particularly to substances. Thus when we pronounce concerning *gold*, that it is fixed, it amounts to no more but this, that fixedness, or a power to remain in the fire unconsumed, is an *idea* that always accompanies that particular sort of *yellowness*, *weight*, *fusibility*, &c. which make our complex *idea* signified by the word *gold*.

4. The fourth sort, is that of actual and *real existence* agreeing to any *idea*. Within these four sorts of agreement or disagreement, is contained all the knowledge we have, or are capable of. For all that we know or can affirm concerning any *idea*, is, That it is, or is not the same with some other; as, that *blue* is not *yellow*: That it does, or does not co-exist with another in the same subject; as, that *iron* is susceptible of *magnetical impressions*; That it has that or this relation to some other *ideas*; as, That *two triangles*, upon equal bases between two parallels, are equal: or, that it has a real existence without the mind; as, that *God* is.

There are several ways wherein the mind is possessed of truth, each of which is called knowledge. *First*, There is *actual knowledge*, when the mind has a present view of the agreement or disagreement of any of its *ideas*, or of the relation they have one with another. *Secondly*, A man is said to know any proposition, when having once evidently perceived the agreement or disagreement of the *ideas* whereof it consists, and so lodged it in his memory, that whenever it comes to be reflected on again, the mind assents to it without doubt or hesitation, and is certain of the truth of it. And this may be called *habitual knowledge*. And thus a man may be said to know all those truths which are lodged in his memory by a foregoing, clear, and full perception.

*Of habitual knowledge* there are two sorts: The one is of such truths laid up in the memory, as whenever they occur to the mind, it actually perceives the relation that is between those *ideas*. And this is in all those truths, where the *ideas* themselves, by an immediate view, discover their agreement or disagreement one with another. The other is of such truths, whereof the mind having been convinced, it retains the memory of the conviction, without the proofs. Thus a man that remembers certainly, that he once perceived the demonstration, that the three angles of a triangle are equal to two right ones, knows it to be true, when that demonstration is gone out

of his mind, and possibly cannot be recollected: But he knows it in a different way from what he did before, namely, not by the intervention of those intermediate *ideas*, whereby the agreement or disagreement of those in the proposition was at first perceived, but by remembering, *i. e.* knowing that he was once certain of the truth of this proposition, that the three angles of a triangle are equal to two right ones. The immutability of the same relations between the same immutable things, is now the *idea* that shews him, that if the three angles of a triangle were once equal to two right ones, they will always be so. And hence he comes to be certain, that what was once true, is always true; what *ideas* once agreed, will always agree; and consequently, what he once knew to be true, he will always know to be true, as long as he can remember that he once knew it.

*Of the degrees of our knowledge.*

ALL our knowledge consisting in the view the mind has of its own *ideas*, which is the utmost light and greatest certainty we are capable of, the *different clearness of our knowledge* seems to lie in the different way of perception the mind has of the agreement or disagreement of any of its *ideas*.

When the mind perceives this agreement or disagreement of two *ideas* immediately by themselves, without the intervention of any other, we may call it *intuitive knowledge*; in which cases the mind perceives truth, as the eye does light, only by being directed towards it. Thus the mind perceives, that *white is not black*; that *three are more than two*, and *equal to one and two*. This part of knowledge is irresistible, and, like the bright sun-shine, forces itself immediately to be perceived as soon as ever the mind turns its view that way. It is on this *intuition* that depends all the certainty and evidence of our other knowledge; which certainty every one finds to be so great, that he cannot imagine, and therefore not require a greater.

The next degree of knowledge, is, where the mind perceives not this agreement or disagreement immediately, or by the *juxta-position*, as it were, of the *ideas*, because those *ideas* concerning whose agreement or disagreement the inquiry is made, cannot by the mind be so put together, as to shew it. In this case the mind is fond to discover the agreement or disagreement which it searches, by the intervention of other *ideas*: And this is that which we call *reasoning*. And thus, if we would know the agreement or disagreement in bigness, between the three angles of a triangle, and two right angles, we cannot by an immediate view and comparing them do it; because the three angles of a triangle cannot be brought at once, and be compared with any other one or two angles. And so of this the mind has no immediate or intuitive knowledge. But we must find out some other angles, to which the three angles of a triangle have equality; and finding those equal to two right ones, we come to know the equality of these three angles to two right ones. Those intervening *ideas* which serve to shew the agreement of any two others, are called *proofs*; and where the agreement or disagreement is by this means plainly and clearly perceived, it is called *demonstration*. A quickness in the mind to find

those proofs, and to apply them right, is that which is called *sagacity*.

This knowledge, though it be certain, is not so clear and evident as *intuitive* knowledge. It requires pains and attention, and steady application of mind, to discover the agreement or disagreement of the *ideas* it considers; and there must be a progression by steps and degrees, before the mind can in this way arrive at certainty. Before demonstration there was a doubt, which, in *intuitive knowledge*, cannot happen to the mind that has its faculty of perception left to a degree capable of distinct *ideas*, no more than it can be a doubt to the eye (that can distinctly see *white* and *black*), whether this ink and paper be all of a colour.

Now, in every step that reason makes in *demonstrative knowledge*, there is an *intuitive knowledge* of that agreement or disagreement it seeks with the next intermediate *idea*, which it uses as a proof; for if it were not so, that yet would need a proof; since without the perception of such agreement or disagreement, there is no knowledge produced. By which it is evident, that every step in reasoning, that produces knowledge, has *intuitive certainty*: which when the mind perceives, there is no more required but to remember it, to make the agreement or disagreement of the *ideas* concerning which we inquire visible and certain. This *intuitive perception* of the agreement or disagreement of the intermediate *ideas* in each step and progression of the demonstration, must also be exactly carried in the mind; and a man must be sure that no part is left out; which because in long deductions the memory cannot easily retain, this knowledge becomes more imperfect than *intuitive*, and men often embrace falsehoods for demonstrations.

It has been generally taken for granted, that *mathematics* alone are capable of demonstrative certainty. But to have such an agreement or disagreement as may be *intuitively* perceived, being not the privilege of the *ideas* of *number*, *extension*, and *figure* alone, it may possibly be the want of due method and application in us, and not of sufficient evidence in things, that demonstration has been thought to have so little to do in other parts of knowledge: For in whatever *ideas* the mind can perceive the agreement or disagreement immediately, there it is capable of *intuitive knowledge*: And where it can perceive the agreement or disagreement of any two *ideas*, by an *intuitive perception* of the agreement or disagreement they have with any intermediate *ideas*, there the mind is capable of demonstration which is not limited to the *ideas* of figure, number, extension, or their modes. The reason why it has been generally supposed to belong to them only, is, because in comparing their equality or excess the *modes of numbers* have every the least difference very clear and perceivable: And in *extension*, though every the least excess is not so perceptible, yet the mind has found out ways to discover the just equality of two angles, extensions, or figures; and both, that is, numbers and figures, can be set down by visible and lasting marks.

But in other simple *ideas*, whose modes and differences are made and counted by degrees, and not quantity, we have not so nice and accurate a distinction of their differences, as to perceive or find ways to measure their just equality,

equality, or the least differences: For those other simple *ideas* being appearances or sensations produced in us by the *size, figure, motion, &c.* of minute corpuscles singly insensible, their different degrees also depend on the variation of some, or all of those causes; which since it cannot be observed by us in particles of matter, whereof each is too subtle to be perceived, it is impossible for us to have any exact measures of the different degrees of these simple *ideas*. Thus, for instance, not knowing what number of particles, nor what motion of them, is fit to produce any precise degree of *whiteness*, we cannot demonstrate the certain equality of any two degrees of *whiteness*, because we have no certain standard to measure them by, nor means to distinguish every the least difference; the only help we have being from our senses, which in this point fail us.

But where the difference is so great as to produce in the mind *ideas* clearly distinct, there *ideas* of *colours*, as we see in different kinds, *blue* and *red*, (for instance,) are as capable of demonstration as *ideas* of number and extension. What is here said of colours, holds true in all secondary qualities. These two then, *intuition* and *demonstration*, are the degrees of our *knowledge*; whatever comes short of one of these, is but *faith* or *opinion, not-knowledge*, at least, in all *general truths*. There is, indeed, another perception of the mind employed about the *particular existence of finite beings* without us; which going beyond probability, but not reaching to either of the foregoing degrees of certainty, passes under the name of *knowledge*.

Nothing can be more certain, than that the *idea* we receive from an external object is in our minds: This is *intuitive knowledge*; but whether we can thence certainly infer the existence of any thing without us, corresponding to that *idea*, is that whereof some men think there may be a question made, because men may have such an *idea* in their minds, when no such things exist, no such object affects their senses. But it is evident that we are invincibly conscious to ourselves of a different perception, when we look upon the *sun* in the day, and think on it by night; when we actually taste *wormwood*, or smell a *rose*, or only think on that *savour* or *odour*. So that we may add to the two former sorts of knowledge, this also of the existence of particular external objects, by that perception and consciousness we have of the actual entrance of *ideas* from them, and allow these three degrees of knowledge, *viz. intuitive, demonstrative, and sensitive*.

But since our knowledge is founded on, and employed about our *ideas* only, will it follow thence that it must be conformable to our *ideas*; and that where our *ideas* are clear and distinct, obscure and confused, there our knowledge will be so too? *No*. For our knowledge consisting in the perception of the agreement or disagreement of any two *ideas*, its clearness or obscurity consists in the clearness or obscurity of that perception, and not in the clearness or obscurity of the *ideas* themselves. A man (for instance) that has a clear *idea* of the angles of a triangle, and of equality to two right ones, may yet have but an obscure perception of their agreement; and so have but a very obscure knowledge of it. But obscure and con-

fused *ideas* can never produce any clear or distinct knowledge; because, as far as any *ideas* are obscure or confused, so far the mind can never perceive clearly whether they agree or disagree.

*Of the extent of human knowledge.*

FROM what has been said concerning knowledge, it follows, *First*, That we can have no knowledge farther than we have *ideas*.

*Secondly*, That we have no knowledge farther than we can have perception of that agreement or disagreement of our *ideas*, either by *intuition, demonstration, or sensation*.

*Thirdly*, We cannot have an *intuitive* knowledge that shall extend itself to all our *ideas*, and all that we would know about them, because we cannot examine and perceive all the relations they have one to another, by juxtaposition, or an immediate comparison one with another. Thus we cannot *intuitively* perceive the equality of two extensions, the difference of whose figures makes their parts incapable of an exact immediate application.

*Fourthly*, Our *rational* knowledge cannot reach to the whole extent of our *ideas*; because between two different *ideas* we would examine, we cannot always find such *proofs* as we can connect one to another, with an *intuitive knowledge* in all the parts of the deduction.

*Fifthly*, *Sensitive* knowledge reaching no farther than the existence of things actually present to our senses, is yet much narrower than either of the former.

*Sixthly*, From all which it is evident, that the *extent of our knowledge*, comes not only short of the reality of *things*, but even of the extent of our own *ideas*. We have the *ideas* of a *square*, a *circle*, and *equality*; and yet, perhaps, shall never be able to find a *circle equal to a square*.

The affirmations or negations we make concerning the *ideas* we have, being reduced to the four sorts above mentioned, *viz. identity, coexistence, relation, and real existence*, we shall examine how far our knowledge extends in each of these.

*First*, As to *identity and diversity*, our *intuitive knowledge* is as far extended as our *ideas* themselves; and there can be no *idea* in the mind, which it does not presently, by an *intuitive knowledge*, perceived to be what it is, and to be different from any other.

*Secondly*, As to the agreement or disagreement of our *ideas* in *coexistence*: In this our knowledge is very short; though in this consists the greatest and most material part of our knowledge, concerning *substances*. For our *ideas* of *substances* being nothing but certain *collections of simple ideas, coexisting in one subject*, (our *idea* of *flame*, for instance, is a body *hot, luminous, and moving upward*;) when we would know any thing farther concerning this, or any other sort of substance, what do we but inquire what other qualities or powers these substances have, or have not? Which is nothing else but to know what other simple *ideas* do or do not *coexist* with those that make up that complex *idea*. The reason of this is, because the simple *ideas* which make up our complex *ideas* of substances, have no visible necessary connection

nection or inconsistency with other simple *ideas* whose coexistence with them we would inform ourselves about. These *ideas* being likewise, for the most part, *secondary qualities*, which depend upon the *primary qualities* of their minute or insensible parts, or on something yet more remote from our comprehension, it is impossible we should know which have a necessary union or inconsistency one with another, since we know not the root from whence they spring; or the size, figure, and texture of parts on which they depend, and from which they result.

Besides this, there is no *discoverable connection* between any *secondary quality*, and those *primary qualities* that it depends on. We are so far from knowing what figure, size, or motion produces (for instance) a *yellow colour*, or *sweet taste*, or a *sharp sound*, that we can by no means conceive how any *size*, *figure*, or *motion* can possibly produce in us the *idea of any colour*, *taste*, or *sound* whatsoever; and there is no conceivable connection between the one and the other.

Our knowledge therefore of coexistence reaches little farther than *experience*. Some few, indeed, of the *primary qualities* have a necessary dependence and visible connection one with another; as *figure* necessarily supposes *extension*, *receiving or communicating motion by impulse* supposes *solidity*. But qualities coexistent in any subject, without this dependence and connection, cannot certainly be known to coexist any farther than experience by our senses informs us. Thus, though upon trial we find *gold yellow*, *weighty*, *malleable*, *fusible*, and *fixed*, yet because none of these have any evident dependence or necessary connection with the other, we cannot certainly know that where any *four* of these are, the *fifth* will be there also, how highly probable soever it may be: But the highest degree of *probability* amounts not to *certainity*; without which there can be no true knowledge: For this coexistence can be no further known, than it is perceived; and it cannot be perceived, but either, in *particular* subjects, by the observation of our senses, or, in *general*, by the necessary connection of the *ideas* themselves.

As to *incompatibility*, or *repugnancy to coexistence*, we may know that any subject can have of each sort of *primary qualities* but one particular at once, one *extension*, one *figure*; and so of sensible *ideas*, peculiar to each sense: for whatever of each kind is present in any subject, excludes all other of that sort; for instance, one subject cannot have *two smells* or *two colours* at the same time.

As to *powers of substances*, which make a great part of our inquiries about them, and are no inconsiderable branch of our knowledge; our knowledge as to these reaches little farther than *experience*; because they consist in a texture and motion of parts which we cannot by any means come to discover. *Experience* is that which in this part we must depend on; and it were to be wished that it were more improved.

As to the third sort, the *agreement or disagreement of our ideas in any other relation*, this is the largest field of knowledge, and it is hard to determinate how far it may extend. This part depending on our sagacity in finding intermediate *ideas* that may shew the habitudes and re-

lations of *ideas*, it is an hard matter to tell when we are at the end of such discoveries. They that are ignorant of *algebra*, cannot imagine the wonders in this kind that are to be done by it; and what farther improvements and helps advantageous to other parts of knowledge the sagacious mind of man may yet find out, it is not easy to determine. The *ideas of quantity* are not those alone that are capable of demonstration and knowledge; other, and perhaps more useful parts of contemplation, would undoubtedly afford us certainty, if vices, passions, and domineering interest, did not oppresse or menace endeavours of this kind.

The *idea of a Supreme Being*, infinite in power, goodness, and wisdom, whose workmanship we are, and on whom we depend; and the *idea of ourselves*, as understanding rational creatures; would, if duly considered, afford such foundations of our *duty*, and *rules of action*, as might place *morality* among the sciences capable of demonstration. The relations of other modes may certainly be perceived, as well as those of number and extension. *Where there is no property, there is no injustice*, is a proposition as certain as any demonstration in *Euclid*: for the *idea of property* being a right to any thing; and the *idea of injustice* being the invasion or violation of that right; it is evident, that these *ideas* being thus established, and these names annexed to them, we can as certainly know this proposition to be true, as that a *triangle has three angles equal to two right ones*. Again, *No government allows absolute liberty*. The *idea of government* being the establishment of society upon certain rules or laws which require conformity to them, and the *idea of absolute liberty* being for any one to do whatever he pleases, we are as capable of being certain of the truth of this proposition, as of any in *mathematicks*.

What has given the advantage to the *ideas of quality*, and made them thought more capable of certainty and demonstration, is,

*First*, That they can be represented by sensible marks which have a nearer correspondence with them than any words or sounds. *Diagrams* drawn on paper are copies of the *ideas*, and not liable to the uncertainty that words carry in their signification: But we have no sensible marks that resemble our *moral ideas*, and nothing but words to express them by; which though when written they remain the same, yet the *ideas* they stand for may change in the same man; and it is very seldom that they are not different in different persons.

*Secondly*, *Moral ideas* are commonly more complex than figures. Whence these two inconveniences follow: *First*, That their names are of more uncertain signification; the precise collection of simple *ideas* they stand for not being so easily agreed on, and so the sign that is used for them in communication always, and in thinking often, does not steadily carry with it the same *idea*. *Secondly*, The mind cannot easily retain those precise combinations so exactly and perfectly as is necessary; in the examination of the habitudes and correspondencies, agreements or disagreements of several of them one with another, especially where it is to be judged off by long deductions, and the intervention of several other complex *ideas*, to shew the agreement or disagreement of two remote ones.

Now one part of these disadvantages in *moral ideas*, which has made them be thought not capable of demonstration, may in a good measure be remedied by *definitions*, setting down that collection of simple *ideas* which every term shall stand for, and then using the terms steadily and constantly for that precise collection.

As to the fourth sort of knowledge, *viz.* of the *real actual existence of things*, we have an *intuitive* knowledge of our *own existence*; a *demonstrative* knowledge of the *existence of God*; and a *sensitive* knowledge of the *objects that present themselves to our senses*.

From what has been said, we may discover the *causes of our ignorance*; which are chiefly these three: *First*, Want of *ideas*: *Secondly*, Want of a discoverable connection between the *ideas* we have: *Thirdly*, Want of tracing and examining our *ideas*.

*First*, There are some things we are ignorant of for want of *ideas*. All the simple *ideas* we have are confined to the observations of our senses, and the operations of our own minds that we are conscious of in ourselves. What other *ideas* it is possible other creatures may have, by the assistance of other senses and faculties more or perfecter than we have, or different from ours, it is not for us to determine; but to say or think there are no such, because we conceive nothing of them, is no better an argument, than if a blind man should be positive in it, that there was no such thing as sight and colours, because he had no manner of *idea* of any such thing. What faculties therefore other species of creatures have to penetrate into the nature and inmost constitutions of things, we know not. This we know, and certainly find, that we want other views of them, besides those we have, to make discoveries of them more perfect. The *intellectual* and *sensible* world are in this perfectly alike, that the parts which we see of either of them, hold no proportion with that we see not; and whatsoever we can reach with our eyes or our thoughts of either of them, is but a point almost nothing in comparison of the rest.

Another great cause of ignorance, is the want of *ideas that we are capable of*. This keeps us in ignorance of things we conceive capable of being known. Bulk, figure, and motion we have *ideas* of; yet not knowing what is the particular bulk, motion, and figure of the greatest part of the bodies of the universe, we are ignorant of the several powers, efficacies, and ways of operation, whereby the effects we daily see are produced. These are hid from us in some things, by being *too remote*; in others, by being *too minute*.

When we consider the vast distance of the known and visible parts of the world, and the reasons we have to think that what lies within our ken is but a small part of the immense universe, we shall then discover an huge abyss of ignorance. What are the particular fabrics of the great masses of matter, which make up the whole stupendous frame of corporeal beings; how far they are extended; and what is their motion, and how continued; and what influence they have upon one another; are contemplations, that at first glimpse our thoughts lose themselves in. If we confine our thoughts to this little system of our sun, and the grosser masses of matter that visibly move about it; what several sorts of vegetables,

animals, and intellectual corporeal beings, infinitely different from those of our little spot of earth, may probably be in other *planets*, to the knowledge of which, even of their outward figures and parts, we can no way attain, whilst we are confined to this earth, there being no natural means, either by sensation or reflection, to convey their certain *ideas* into our minds?

There are other bodies in the universe, no less concealed from us by their *minuteness*. These insensible corpuscles being the active parts of matter, and the great instruments of nature on which depend all their *secondary* qualities and operations, our want of precise distinct *ideas* of their *primary* qualities keeps us in incurable ignorance of what we desire to know about them. Did we know the mechanical affections of *rhubarb* and *opium*, we might as easily account for their operations of *purging* or *causing sleep*, as a watchmaker can for the motions of his watch. The dissolving of silver in *aqua fortis*, or gold in *aqua regia*, and not *vice versa*, would be then, perhaps, no more difficult to know, than it is to a *smith* to understand why the turning of one key will open a lock, and not the turning of another. But whilst we are destitute of senses acute enough to discover the minute particles of bodies, and to give us *ideas* of their mechanical affections, we must be content to be ignorant of their properties and operations: Nor can we be assured about them any farther than some few trials we make are able to reach; but whether they will succeed again another time, we cannot be certain. This hinders our certain knowledge of universal truths concerning natural bodies; and our reason carries us herein very little beyond particular matters of fact. And therefore, how far soever human industry may advance useful and *experimental philosophy* in physical things, yet *scientific* will still be out of our reach; because we want perfect and adequate *ideas* of those very bodies which are nearest to us, and most under our command.

This, at first sight, shews us how disproportionate our knowledge is to the whole extent, even of *material* beings; to which if we add the consideration of that infinite number of *spirits* that may be, and probably are, which are yet more remote from our knowledge, whereof we have no cognizance; we shall find this cause of ignorance concealed from us, in an impenetrable obscurity, almost the whole *intellectual* world, a greater certainly, and a more beautiful world than the *material*: For bating some very few *ideas* of spirit we get from our own mind by reflection, and from thence the best we can collect of the *Father of all spirits*, the Author of them and us and all things, we have no certain information so much as of the existence of other spirits but by revelation; much less have we distinct *ideas* of their different natures, states, powers, and several constitutions, wherein they agree or differ one from another, and from us: And therefore in what concerns their different species and properties, we are under an absolute ignorance.

The second cause of ignorance, is the want of *discoverable connection* between those *ideas* we have: Where we want that, we are utterly incapable of *universal* and *certain* knowledge: and are, as in the former case, left only to *observation* and *experiment*. Thus the mechanical

nical affections of bodies having no affinity at all with the *ideas* they produce in us, we can have no distinct knowledge of such operations beyond our experience; and can reason no otherwise about them, than as the effects or appointment of an infinitely wise agent, which perfectly surpasses our comprehensions.

The operation of our minds upon our bodies, is as inconceivable. How any *thought* should produce a motion in *body*, is as remote from the nature of our *ideas*, as how any *body* should produce any *thought* in the *mind*. That it is so, if experience did not convince us, the consideration of the things themselves would never be able in the least to discover to us.

In some of our *ideas* there are certain relations, habits, and connections, so visibly included in the nature of the *ideas* themselves, that we cannot conceive them separable from them by any power whatsoever: In these only we are capable of certain and universal knowledge. Thus the *idea* of a *right lined triangle*, necessarily carries with it an *equality of its angles to two right ones*. But the coherence and continuity of the parts of matter, the production of sensation in us of *colours* and *sounds*, &c. by impulse and motion, being such wherein we can discover no natural connection with any *ideas* we have, we cannot but ascribe them to the arbitrary will and good pleasure of the wise Architect.

The things that we observe constantly to proceed regularly, we may conclude to act by a law set them; but yet by a law that we know not; whereby, though causes work steadily, and effects constantly flow from them, yet their connections and dependencies being not discoverable in our *ideas*, we can have but an experimental knowledge of them.

The *third cause of ignorance*, is our *want of tracing those ideas we have* or may have, and finding out those intermediate *ideas* which may shew us what habitude of agreement or disagreement they may have one with another: And thus many are ignorant of *mathematical* truths, for want of application in inquiring, examining, and by due ways comparing those *ideas*.

Hitherto we have examined the *extent* of our knowledge, in respect of the several sorts of beings that are: There is another *extent* of it, in respect of *universality*, which will also deserve to be considered; and in this regard our knowledge follows the nature of our *ideas*. If the *ideas* are *abstract*, whose agreement or disagreement we perceive, our knowledge is *universal*. For what is known of such general *ideas*, will be true of every particular thing in which that *essence*, that is, *abstract idea*, is to be found: And what is once known of such *ideas*, will be perpetually, and for ever true. So that, as to all general knowledge, we must search and find it only in our own minds: And it is only the examining of our own *ideas* that furnishes us with that. Truths belonging to essences of things, (that is, to *abstract ideas*), are *eternal*, and are to be found out by the contemplation only of those essences, as the existence of things is to be known only from experience.

*Of the reality of our knowledge.*

THE reader by this time may be ready to object, If

it be true, that all knowledge lies only in the perception of the agreement or disagreement of our own *ideas*, the visions of an *enthusiast*, and the reasonings of a *superstition*, will be equally certain: It is no matter how things are, so a man observe but the agreement of his own imaginations, and talk conformably; it is all truth, all certainty.

To this it is answered, that if our knowledge of our *ideas* should terminate in them, and reach no farther, where there is something farther intended, our most serious thoughts would be of little more use than the *reveries* of a crazy brain. But it is evident, that this way of *certainty*, by the knowledge of our own *ideas*, goes a little farther than bare imagination: and that all the certainty of general truths a man has, lies in nothing else but this knowledge of our *ideas*.

It is evident, that the mind knows not things immediately, but by the intervention of the *ideas* it has of them. Our knowledge there ore is *real*, only so far as there is a conformity between our *ideas* and the reality of things. But how shall we know when our *ideas* agree with things themselves? There are *two sorts of ideas*, that we may be assured agree with things: These are,

*First*, *Simple ideas*; which since the mind can by no means make to itself, must be the effect of things operating upon the mind in a natural way, and producing therein those perceptions, which, by the will of our Maker, they are ordained and adapted to. Hence it follows, that *simple ideas* are not fictions of our fancies, but the natural and regular productions of things without us, really operating upon us; which carry with them all the conformity our state requires, which is to represent things under those appearances they are fitted to produce in us. Thus the *idea of whiteness*, as it is in the mind, exactly answers that power which is in any body to produce it there. And this conformity between our *simple ideas*, and the existence of things, is sufficient for real knowledge.

*Secondly*, All our *complex ideas*, except those of substances, being *archetypes* of the mind's own making, and not referred to the existence of things as to their originals, cannot want any conformity necessary to real knowledge: For that which is not designed to represent any thing but itself, can never be capable of a wrong representation. Here the *ideas* themselves are considered as *archetypes*, and things no otherwise regarded than as they are conformable to them. Thus the *mathematician* considers the truth and properties belonging to a *rectangle*, or *circle*, only as they are *ideas* in his own mind, which possibly he never found existing mathematically, that is, precisely true; yet his knowledge is not only certain, but *real*; because real things are no farther concerned, nor intended to be meant by any such propositions, than as things really agree to those *archetypes* in his mind. It is true of the *idea* of a *triangle*, that *its three angles are equal to two right ones*: It is true also of a *triangle*, wherever it *exists*: What is true of those *figures*, that have barely an *ideal* existence in his mind, will hold true of them also when they come to have a *real* existence in nature.

Hence it follows, that *moral* knowledge is as capable of *real certainty* as *mathematicks*: For *certainty* being nothing

nothing but the perception of the agreement or disagreement of our *ideas*, and demonstration nothing but the perception of such agreement by the intervention of other *ideas*, our *moral ideas*, as well as *mathematical*, being *archetypes* themselves, and so adequate or complete *ideas*, all the agreement or disagreement we shall find in them will produce *real knowledge*, as well as in *mathematical figures*. That which is requisite to make our knowledge *certain*, is, the clearness of our *ideas*; and that which is required to make it *real*, is, that they answer their *archetypes*.

*Thirdly*, But the complex *ideas*, which we refer to *archetypes* without us, may differ from them, and so our knowledge about them may come short of being *real*; and such are our *ideas of substances*. These must be taken from something that does or has existed, and not be made up of *ideas* arbitrarily put together, without any real pattern. Herein, therefore, is founded the reality of our knowledge concerning *substances*, that all our complex *ideas* of them must be such, and such only, as are made up of such simple ones as have been discovered to coexist in nature. And our *ideas* being thus true, tho' not perhaps very exact copies, are the subjects of the *real knowledge* of them. Whatever *ideas* we have, the agreement we find they have with others will be knowledge. If those *ideas* be abstract, it will be *general knowledge*. But to make it *real* concerning *substances*, the *ideas* must be taken from the real existence of things. Wherever, therefore, we perceive the agreement or disagreement of our *ideas*, there is *certain knowledge*: And wherever we are sure those *ideas* agree with the reality of things, there is *certain real knowledge*.

#### *Of truth in general.*

TRUTH, in the proper import of the word, signifies the joining or separating of signs, as the things signified by them do agree or disagree one with another. The joining or separating of signs, is what we call *propositions*; so that *truth* properly belongs only to *propositions*: Whereof there are two sorts, *mental* and *verbal*; as there are two sorts of signs commonly made use of, *ideas* and *words*.

It is difficult to treat of *mental propositions* without *verbal*: because, in speaking of *mental*, we must make use of *words*, and then they become *verbal*. Again, men commonly in their thoughts and reasonings use *words* instead of *ideas*; especially if the subject of their meditation contains in it complex *ideas*. If we have occasion to form *mental propositions* about *white*, *black*, *circle*, &c. we can, and often do, frame in our minds the *ideas* themselves, without reflecting on the *names*: But when we would consider, or make propositions about the more complex *ideas*, as of a *man*, *virtue*, *fortitude*, *glory*, &c. we usually put the *name* for the *idea*; because the *idea* these *names* stand for being for the most part confused, imperfect, and undetermined, we reflect on the *names* themselves, as being more clear, certain, and distinct, and readier to occur to our thoughts, than pure *ideas*; and so we make use of these *words* instead of the *ideas* themselves, even when we would meditate and reason within ourselves, and make tacit *mental propositions*.

We must then observe two sorts of *propositions* that we are capable of making: *First*, *Mental propositions*, wherein the *ideas* in our understandings are put together or separated by the mind perceiving or judging of their agreement or disagreement. *Secondly*, *Verbal propositions*; which are words put together or separated in affirmative or negative sentences: So that *proposition* consists in joining or separating signs; and *truth* consists in putting together or separating these signs, according as the things they stand for agree or disagree.

*Truth*, as well as knowledge, may well come under the distinction of *verbal* and *real*; that being only *verbal truth*, wherein terms are joined according to the agreement or disagreement of the *ideas* they stand for, without regarding whether our *ideas* are such as really have or are capable of having an existence in nature. But then it is they contain *real truth*, when these signs are joined as our *ideas* agree: and when our *ideas* are such as, we know, are capable of having an existence in nature; which in substances we cannot know, but by knowing that such have existed. *Truth* is the marking down in words the agreement or disagreement of *ideas* as it is: *Falsehood* is the marking down in words the agreement or disagreement of *ideas* otherwise than it is; and so far as these *ideas*, thus marked by sounds, agree to their *archetypes*, so far only is the *truth real*. The knowledge of this *truth* consists in knowing what *ideas* the words stand for, and the perception of the agreement or disagreement of those *ideas*, according as it is marked by those words.

Besides *truth* taken in the strict sense before mentioned, there are other sorts of *truths*: As, *first*, *Moral truth*; which is speaking things according to the persuasion of our own minds. *Secondly*, *Metaphysical truth*; which is nothing but the real existence of things conformable to the *ideas* to which we have annexed their names.

These considerations of *truth* either having been before taken notice of, or not being much to our present purpose, it may suffice here only to have mentioned them.

#### *Of our knowledge of existence.*

HITHERTO we have only considered the *essences* of things; which being only *abstract ideas*, and thereby removed in our thoughts from particular existence, give us no knowledge of *existence* at all. We proceed now to inquire concerning our *knowledge of the existence* of things, and how we come by it.

We have the knowledge of our *own existence* by *intuition*; of the *existence of God*, by *demonstration*; and of *other things*, by *sensation*. As for our *own existence*, we perceive it so plainly, that it neither needs, nor is capable of any proof. *I think*, *I reason*, *I feel pleasure and pain*: can any of these be more evident to me than my *own existence*? If I doubt of all other things, that very *doubt* makes me perceive my *own existence*, and will not suffer me to doubt of that. If I know I doubt, I have as certain a perception of the *thing* doubting, as of that *thought* which I call *doubt*. Experience then convinces us, that we have an *intuitive knowledge of our own existence*; and an internal infallible perception that we *are*. In every act of sensation, reasoning, or thinking, we are conscious to ourselves of our own being;

and

and in this matter come not short of the highest degree of certainty.

*Of our knowledge of the existence of a God.*

THOUGH God has given us no *innate ideas* of himself, yet having furnished us with those faculties our minds are endowed with, he hath not *left himself without a witness*, since we have sense, perception, and reason, and cannot want a clear proof of him as long as we carry ourselves about us. Nor can we justly complain of our ignorance in this great point, since he has so plentifully provided us with means to discover and know him, so far as is necessary to the end of our being, and the great concernment of our happiness. But though this be the most obvious truth that reason discovers, yet it requires thought and attention; and the mind must apply itself to a regular deduction of it, from some part of our *intuitive knowledge*; or else we shall be as ignorant of this, as of other propositions which are in themselves capable of clear demonstration. To shew, therefore, that we are capable of knowing, that is, *being certain*, that *there is a God*, and how we may come by this certainty, we need go no farther than ourselves, and that undoubted knowledge we have of our own *existence*. It is beyond question, that *man has a clear perception of his own being*: He knows certainly that he exists, and that he is something. In the next place, man knows by an *intuitive certainty*, that *bare nothing can no more produce any real being, than it can be equal to two right angles*. If therefore, we know there is some real being, it is an evident demonstration, that *from eternity there has been something*; since what was not from eternity had a beginning; and what had a beginning, must be produced by something else. Next, it is evident, that *what has its being from another, must also have all that which is in and belongs to its being from another too*: All the powers it has, must be owing to, and received from the same source. This eternal source then of all being must be also the source and original of all power; and so this *eternal Being* must be also the *most powerful*.

Again, man finds in himself *perception and knowledge*: We are certain, then, that there is not only some being, but some knowing intelligent being in the world. There was a time, then, when there was no knowing being, or else there has been a knowing being from eternity. If it be said, there was a time when that eternal being had no knowledge; the reply is, that then it is impossible there should have ever been any knowledge; it being as impossible that things wholly void of knowledge, and operating blindly, and without any perception, should produce a knowing being, as it is that a triangle should make itself three angles bigger than two right ones.

Thus from the consideration of ourselves, and what we infallibly find in our own constitutions, our reason leads us to the knowledge of this certain and evident truth, that *there is an eternal, most powerful, and knowing being*; and from this *idea* duly considered, will easily be deduced all those other *attributes* we ought to ascribe to this *eternal being*.

From what has been said, it is plain, we have a more certain knowledge of the existence of a *God*, than of any

thing our senses have not immediately discovered to us; nay, that we more certainly know that there is a *God*, than that there is any thing else without us.

It being then unavoidable for all rational creatures to conclude, that *something has existed from eternity*: let us next see what *kind of thing* that must be. There are but two sorts of beings in the world, that man knows or conceives. *First*, Such as are purely material, without sense or perception, as the clippings of our beards, and parings of our nails. *Secondly*, Sensible perceiving beings; such as we find ourselves to be. These two sorts we shall hereafter call *cogitative* and *incogitative* beings: Which to our present purpose are better than *material* and *immaterial*.

If then there must be something *eternal*, it is very obvious to reason, that it must necessarily be a *cogitative* being; because it is as impossible to conceive that ever bare *incogitative* matter should produce a *thinking* intelligent being, as that nothing should of itself produce matter. Let us suppose any parcel of matter *eternal*, we shall find it in itself unable to produce any thing. Let us suppose its parts firmly at rest together: If there were no other being in the world, must it not eternally remain so, a dead unactive lump? Is it possible to conceive it can add motion to itself, or produce any thing? *Matter* then by its own strength cannot produce in itself so much as *motion*. The motion it has must also be from eternity, or else added to matter by some other being more powerful than matter. But let us suppose motion eternal too; yet matter, *incogitative* matter and motion, could never produce *thought*: *Knowledge* will still be as far beyond the power of *motion* and *matter* to produce, as matter is beyond the power of nothing to produce. Divide *matter* into as minute parts as you will, vary the figure and motion of it as much as you please, it will operate no otherwise upon other bodies of proportionable bulk, than it did before this division. The minutest particles of matter knock, impel, and resist one another, just as the greater do; and that is all they can do. So that if we will suppose *nothing eternal*, *matter can never begin to be*: If we suppose *bare matter* without motion *eternal*, *motion can never begin to be*: If we suppose only matter and motion eternal, *thought can never begin to be*: For it is impossible to conceive that matter, either with or without motion, could have originally, in and from itself sense, perception, and knowledge; as is evident from hence, that then sense, perception and knowledge, must be a property eternally inseparable from matter and every particle of it. Since therefore whatsoever is the first eternal being, must necessarily be *cogitative*; and whatsoever is first of all things, must necessarily contain in it, and actually have, at least all the perfections that can ever after exist, it necessarily follows, that the *first eternal being cannot be matter*.

If therefore it be evident that something necessarily must exist from eternity, it is also evident, that that *something must necessarily be a cogitative being*: For it is as impossible that *incogitative matter* should produce a *cogitative being*, as that nothing, or the negation of all being, should produce a positive being or matter.

This discovery of the necessary existence of an Eternal Mind,

mind does sufficiently lead us into the knowledge of *God*. For it will hence follow, that all other knowing beings that have a beginning must depend on him, and have no other ways of knowledge or extent of power than what he gives them; and therefore if he made those, he made also the less excellent pieces of this universe, all *inanimate bodies*, whereby his *omniscience*, *power*, and *providence*, will be established; and from thence all his other attributes necessarily follow.

*Of our knowledge of the existence of other things.*

THE knowledge of our own being we have by *intuition*: The existence of a *God*, *reason* clearly makes known to us. The *knowledge of the existence* of any other thing, we can have only by *sensation*; for there being no necessary connection of *real existence* with any *idea* a man hath in his memory; nor of any other existence, but that of *God*, with the existence of any particular man; no particular man can know the existence of any other being, but only when, by actually operating upon him, it makes itself be perceived by him. The having the *idea* of any thing in our mind, no more proves the existence of that thing, than the picture of a man evidences his being in the world, or the visions of a dream make thereby a true history. It is therefore the actual receiving of *ideas* from without, that gives us notice of the existence of other things, and makes us know that something doth exist at that time without us, which causes that *idea* in us, though perhaps we neither know nor consider how it does it; for it takes not from the *certainty* of our senses, and the *ideas* we receive by them, that we know not the manner wherein they are produced. This *notice* we have by our *senses* of the existing of things without us, though it be not altogether so certain as *intuition* and *demonstration*, deserves the name of knowledge, if we persuade ourselves that our faculties act and inform us right concerning the existence of those objects that affect them. But besides the assurance we have from our *senses* themselves, that they do not err in the information they give us of the existence of things without us, we have other concurrent reasons: As, *First*, It is plain those perceptions are produced in us by exterior causes affecting our senses, because those that want the *organs* of any *sense* never can have the *ideas* belonging to that sense produced in their minds. This is too evident to be doubted; and therefore we cannot but be assured, that they come in by the organs of that sense, and no other way.

*Secondly*, Because we find sometimes that we cannot avoid the having those *ideas* produced in our minds. When my eyes are shut, I can at pleasure recall to my mind the *ideas* of *light*, or the *sun*, which former sensations had lodged in my memory: But if I turn my eyes towards the *sun*, I cannot avoid the *ideas* which the *light* or the *sun* then produces in me. Which shews a manifest difference between those *ideas* laid up in the memory, and such as force themselves upon us, and we cannot avoid having. And therefore it must needs be some *exterior* cause, whose efficacy I cannot resist, that produces those *ideas* in my mind whether I will or no.

Besides, there is nobody who doth not perceive the difference in himself, between actually looking upon the

*sun*, and contemplating the *idea* he has of it in his memory; and therefore he hath certain knowledge, that they are not both memory or fancy, but that actual seeing has a cause without.

*Thirdly*, Add to this, that many *ideas* are produced in us with pain, which we afterwards remember without the least offence. Thus the pain of *heat* or *cold*, when the *idea* of it is received in our minds, gives us no disturbance, which, when felt, was very troublesome; and we remember the pain of *hunger*, *thirst*, *head-ach*, &c. without any pain at all, which would either never disturb us, or else constantly do it, as often as we thought of it, were there nothing more but *ideas* floating in our minds, and appearances entertaining our fancies, without the real existence of things affecting us from abroad.

*Fourthly*, Our *senses* in many cases bear witness to the truth of each other's report concerning the existence of sensible things without us: he that doubts when he sees a *fire*, whether it be *real*, may, if he please, feel it too; and by the exquisite pain he will be convinced, that it is not a bare *idea* or *phantom*.

If after all this, any one will be so *sceptical*, as to distrust his senses, and to question the existence of all things, or our knowledge of any thing, let him consider that the certainty of things existing in *rerum natura*, when we have the testimony of our senses for it, is not only as great as our frame can attain to, but as our condition needs. For our *faculties* being not suited to the full extent of being, nor a clear comprehensive knowledge of all things, but to the preservation of us in whom they are, and accommodated to the use of life; they serve our purpose well enough, if they will but give us certain notice of those things that are convenient or inconvenient to us: For he that sees a *candle* burning, and has experimented the force of the flame, by putting his finger in it, will little doubt that this is something existing without him which does him harm, and puts him to pain; which is assurance enough; when no man requires greater certainty to govern his actions by, than what is as certain as his actions themselves: So that this evidence is as great as we can desire, being as certain to us as our pleasure or pain, that is, *happiness* or *misery*; beyond which we have no concernment either of knowing or being.

In fine, when our *senses* doth actually convey into our understandings any *idea*, we are assured that there is something at that time *really existing* without us. But this knowledge extends only as far as the present testimony of our senses, employed about particular objects, that do then affect them, and no farther. My seeing a *man* a minute since, is no certain argument of his present existence.

As when our *senses* are actually employed about any object, we know that it does exist; so by our memory we may be assured, that heretofore things that affected our *senses* have existed: And thus we have the knowledge of the past existence of several things. whereof our senses having informed us, our memories still retain the *ideas*; and of this we are past all doubt, so long as we remember well.

As to the *existence of spirits*, our having *ideas* of them does not make us know that any such things do exist without

without us, or that there are any *finite spirits*, or any other *spiritual beings* but the *eternal God*. We have ground from *revelation*, and several other reasons, to believe with assurance, that there are such creatures: But our senses not being able to discover them, we want the means of knowing their particular existence; for we can no more know that there are *finite spirits* really existing, by the *ideas* we have of such beings, than by the *ideas* any one has of *fairies*, or *centaurs*, he can come to know, that things answering those *ideas* do really exist.

Hence we may gather, that there are *two sorts* of propositions: *One* concerning the existence of any thing answerable to such an *idea*, as that of an *elephant*, *phoenix*, *motion*, or *angel*, *viz.* whether such a thing does any where exist: And this knowledge is only of *particulars*, and not to be had of any thing without us, but only of *God*, any other way than by our *senses*.

*Another sort* of proposition is, wherein is expressed the agreement or disagreement of our *abstract ideas*, and their dependance one on another. And these may be *universal* and certain: so having the *idea* of *God* and my *self*, of *fear* and *obedience*, I cannot but be sure that *God is to be feared and obeyed by me*: and this proposition will be certain concerning *man* in general, if I have made an *abstract idea* of such a *species*, whereof I am one particular. But such a proposition, how certain soever, proves not to me the existence of men in the world; but will be true of all such creatures, whenever they do exist: which *certainty* of such general propositions, depends on the agreement or disagreement discoverable in those *abstract ideas*. In the former case, our knowledge is the consequence of the *existence* of things producing *ideas* in our minds by our senses: in the latter, the consequences of the *ideas* that are in our minds, and producing these general propositions, many whereof are called *eterna veritates*: and all of them indeed are so; not from being written all or any of them in the minds of all men, or that they were any of them propositions in any one's mind, till he, having got the *abstract ideas*, joined or separated them by affirmation or negation; but wheresoever we can suppose such a creature as *man* is, endowed with such faculties, and thereby furnished with such *ideas* as we have, we must conclude he must needs, when he applies his thoughts to the consideration of his *ideas*, know the truth of certain propositions that will arise from the agreement or disagreement he will perceive in his own *ideas*. Such propositions being once made about *abstract ideas*, so as to be true, they will, whenever they can be supposed to be made again, at any time past, or to come, by a mind having those *ideas*, always be true: for names being supposed to stand perpetually for the same *ideas*, and the same *ideas* having immutably the same habitudes one to another, propositions concerning any *abstract ideas* that are once true must needs be *eterna verities*.

#### Of judgment.

THE *understanding faculties* being given to man, not barely for speculation, but also for the conduct of his life, a man would be at a great loss, if he had nothing to direct him but what has the certainty of true knowledge.

He that will not *eat* till he has demonstration that it will nourish him, nor *stir* till he is infallibly assured of success in his business, will have little else to do but *sit still*, and *perish*.

Therefore as *God* hath set some things in broad *day-light*; as he has given us some certain knowledge, though limited to a few things, in comparison, (probably as a taste of what *intellectual* creatures are capable of, to excite in us a desire and endeavour after a better state;) so in the greatest part of our concernment, he has afforded us only the *twilight* of *probability*, suitable to that state of *mediocrity* and *probationership* he has been pleased to place us in here.

The faculty which *God* has given *man* to enlighten him, next to certain knowledge, is *judgment*; whereby the mind takes its *ideas* to agree or disagree, without perceiving a demonstrative evidence in the proofs. The mind exercises this judgment sometimes out of *necessity*, where demonstrative proofs and certain knowledge are not to be had; and sometimes out of *laziness*, *unskilfulness*, or *haste*, even where they are to be had.

This faculty of the mind, when it is exercised immediately about things, is called *judgment*; when about truths delivered in words, is most commonly called *assent* or *dissent*. Thus the mind has *two faculties* conversant about truth and falsehood: First, *Knowledge*; whereby it certainly perceives, and is undoubtedly satisfied of the agreement or disagreement of any ideas. Secondly, *Judgment*, which is the putting *ideas* together, or separating them from one another in the mind, when their certain agreement or disagreement is not perceived, but presumed to be so. And if it so unites or separates them as in reality things are, it is *right judgment*.

#### Of probability.

PROBABILITY is nothing but the appearance of the agreement or disagreement of two *ideas*, by the intervention of proofs, whose connection is not constant and immutable, or is not perceived to be so; but is or appears for the most part to be so; and is enough to induce the mind to judge the proposition to be *true* or *false*, rather than the contrary.

Of *probability* there are degrees, from the neighbourhood of *certainty* and *demonstration*, quite down to *improbability* and *unlikeliness*, even to the confines of *impossibility*: And also degrees of *assent* from certain knowledge, and what is next it, full assurance and confidence, quite down to conjecture, doubt, distrust, and disbelief.

That proposition then is *probable*, for which there are arguments or proofs to make it pass or be received for *true*: The entertainment the mind gives to this sort of propositions, is called *belief*, *assent*, or *opinion*. *Probability* then being to supply the defect of our knowledge, is always conversant about propositions whereof we have no *certainty*, but only some *inducements* to receive them for true. The grounds of it are, in short, *these two* following.

First, The *conformity* of anything with our own knowledge, experience, or observation.

Secondly, The *testimony* of others, vouching their observation and experience. In the *testimony* of others is

to be considered, *First*, The number; *Secondly*, The integrity; *Thirdly*, The skill of the witnesses; *Fourthly*, The design of the author, if it be a testimony cited out of a book; *Fifthly*, The consistency of the parts and circumstances of the relation; *Sixthly*, Contrary testimonies.

The mind, before it rationally *assents* or *dissents* to any probable proposition, ought to examine all the grounds of *probability*, and see how they make, more or less, for or against it; and upon a due balancing of the whole, reject or receive it, with a more or less firm *assent*, according to the preponderancy of the greater grounds of *probability* on one side, or the other.

*Of the degrees of assent.*

THE grounds of *probability*, laid down in the foregoing section, as they are the foundations on which our *assent* is built, so are they also the measure whereby its several degrees are (or ought to be) regulated. Only we are to take notice, that no grounds of probability operate any farther on the mind, which searches after truth, and endeavours to judge right, than they appear, at least, in the first judgment or search that the mind makes. It is indeed in many cases impossible, and in most very hard, even for those who have admirable memories, to retain all the proofs which, upon a due examination, made them embrace that side of the question. It suffices, that they have once, with care and fairness, sifted the matter as far as they could; and having once found on which side the *probability* appeared to them, they lay up the conclusion in their memories, as a *truth* they have discovered; and for the future remain satisfied with the testimony of their memories, that this is the opinion, that, by the proofs they have once seen of it, deserves such a degree of their *assent* as they afford it.

It is unavoidable then that the memory be relied on in this case, and that men be persuaded of several *opinions*, whereof the proofs are not actually in their thoughts, nay, which perhaps they are not able actually to recall: Without this the greatest part of men must be either *sceptics*, or change every moment, when any one offers them arguments which for want of memory, they are not presently able to answer.

It must be owned, that mens sticking to past judgments, is often the cause of great *obstinacy* in error and mistake. But the fault is not that they rely on their memories for what they have before well judged, but because they judged before they had well examined. Who almost is there that hath the leisure, patience, and means, to collect together all the proofs concerning most of the opinions he has, so as safely to conclude, that he has a clear and full view, and that there is no more to be alleged for his better information? And yet we are forced to determine ourselves on one side, or other: The conduct of our lives, and the management of our great concerns, will not bear delay: For those depend, for the most part, on the determination of our judgment in points, wherein we are not capable of certain knowledge, and wherein it is necessary for us to embrace one side or the other.

The propositions we receive upon inducements of *probability*, are of two sorts: *First*, Concerning some parti-

cular existence, or matter of *fact*, which falling under our observation, is capable of *human testimony*: *Secondly*, Concerning things which, being beyond the discovery of our *senses*, are not capable of human testimony.

Concerning the first of these, *viz.* *Particular matter of fact*.

*First*, Where any particular thing, consonant to the constant observation of ourselves, and others, in the like case, comes attested with the concurrent reports of all that mention it, we receive it as easily, and build as firmly upon it, as if it were certain knowledge. Thus, if all *Englishmen*, who have occasion to mention it, should report, that it *froze* in *England* last winter, or the like, a man would as little doubt of it, as that *seven* and *four* are *eleven*.

The *first* and *highest* degree of *probability* then is, when the general consent of all men, in all ages, as far as can be known, concurs with a man's own constant experience in the like cases, to confirm the truth of any particular matter of fact, attested by fair witnesses: Such are the stated *constitutions* and *properties* of bodies, and the regular proceedings of *causes* and *effects* in the ordinary course of *nature*. This we call an *argument* from the nature of things themselves: For what we and others always observe to be after the same manner, we conclude with reason to be the effects of steady and regular *causes*, though they come not within the reach of our knowledge; as that fire warmed a man, or made *lead fluid*; that *iron* sunk in water, swam in quicksilver. A relation affirming any such thing to have been, or a predication that it will happen again in the same manner, is received without doubt or hesitation; and our *belief* thus grounded, rises to *assurance*.

*Secondly*, The next degree of *probability*, is when by my own experience, and the agreement of all others that mention it, a *thing* is found to be for the most part so; and that the particular instance of it is attested by many and undoubted *witnesses*. Thus *history* giving us such an account of men in all ages, and my own experience confirming it, that most men prefer their own private advantage to the public; if all historians that write of *Tiberius*, say that he did so, it is extremely probable: And in this case, our *assent* rises to a degree which we may call *confidence*.

*Thirdly*, In matters happening indifferently, as that a *bird* should fly this or that way; when any particular matter of fact comes attested by the concurrent testimony of unsuspected *witnesses*, there our *assent* is also unavoidable. Thus, that there is in *Italy* such a city as *Rome*; that about one thousand and seven hundred years ago there lived such a man in it as *Julius Cæsar*, &c. a man as little doubt of this, and the like, as he does of the being and actions of his own acquaintance, whereof he himself is a witness.

*Probability*, on these grounds, carries so much evidence with it, that it leaves us as little liberty to believe or disbelieve, as demonstration does, whether we will know or be ignorant. But the difficulty is, when testimonies contradict common experience, and the reports of witnesses clash with the ordinary course of nature, or with one another; here diligence, attention, and exactness, is required

quired to form a *right judgment*, and to proportion the *assent* to the evidence and *probability* of the thing, which rises and falls according as the two foundations of credibility favour or contradict it. These are liable to such variety of contrary observations, circumstances, reports, tempers, designs, over-sight, &c. of reporters, that it is impossible to reduce to precise rules the various degrees wherein men give their *assent*. This in general may be said, that as the *proofs*, upon due examination, shall to any one appear in a greater or less degree to preponderate on either side, so they are fitted to produce in the mind such different entertainments, as are called *belief, conjecture, guess, doubt, wavering, distrust, disbelief, &c.*

It is a *rule* generally approved, that any testimony, the farther off it is removed from the original truth, the less force it has: And in *traditional* truths, each remove weakens the force of the *proof*. There is a *rule* quite contrary to this, advanced by some men, who look on *opinions* to gain force by growing *older*. Upon this ground, propositions evidently false or doubtful in their first beginning, come by an inverted *rule of probability* to pass for *authentic* truths; and those which deserved little credit from the mouths of their first relators, are thought to grow *venerable* by age, and are urged as undeniable.

But certain it is, that no *probability can rise above its first original*. What has no other evidence than the single testimony of *one witness*, must stand or fall by his *only* testimony, though afterwards cited by hundreds of others; and is so far from receiving any strength thereby, that it becomes the weaker; because passion, interest, inadvertency, mistake of his meaning, and a thousand odd reasons, which capricious mens minds are acted by, may make one man quote another's words or meaning wrong. This is certain, that what in one age was affirmed upon slight grounds, can never after come to be more valid in future ages by being often repeated.

The *second sort of probability*, is concerning things not falling under the reach of our senses, and therefore not capable of testimony: And such are,

1<sup>st</sup>, The existence, nature, and operations of *finite immaterial* beings without us, as *spirits, angels, &c.* or the existence of *material* beings such as, for their smallness or remoteness, our *senses* cannot take notice of; as whether there be any *plants, animals, &c.* in the *planets*, and other mansions of the vast universe.

2<sup>dly</sup>, Concerning the manner of operation in most parts of the works of *nature*; wherein though we see the sensible *effects*, yet their causes are unknown, and we perceive not the ways and manner how they are produced. We see *animals* are generated, nourished, and move; the *loadstone* draws *iron*, &c. But the causes that operate, and the manner they are produced in, we can only guess, and probably conjecture. In these matters *analogy* is the only help we have; and it is from that alone we draw all our grounds of *probability*. Thus observing, that the bare rubbing of two bodies violently upon one another, produces *heat*, and very often *fire*, we have reason to think, that what we call *heat* and *fire* consists in a certain violent agitation of the imperceptible minute parts of the burning matter. This sort of *probability*, which is the best cen-

duct of rational experiments, and the rise of *hypothese* has also its use and influence. And a wary reasoning from *analogy* leads us often into the discovery of *truths* and useful *deductions*, which would otherwise lie concealed.

Though the common experience, and the ordinary course of things, have a mighty influence on the minds of men, to make them give or refuse credit to any thing proposed to their belief; yet there is one case wherein the strangeness of the fact lessens not the *assent* to a fair testimony given of it. For where such supernatural *events* are suitable to ends aimed at by Him who has the power to change the course of nature, there, under such circumstances, they may be the fitter to procure belief, by how much the more they are beyond or contrary to ordinary observation. This is the proper case of *miracles*; which, well attested, do not only find credit themselves, but give it also to other *truths*.

There are propositions that challenge the highest degree of our *assent* upon bare testimony, whether the thing proposed agree or disagree with common experience and the ordinary course of things or no: The reason whereof is, because the testimony is of such an *one* as cannot deceive nor be deceived; and that is *God* himself. This carries with it certainty beyond doubt, evidence beyond exception. This is called by a peculiar name, *revelation*, and our *assent* to it, *faith*, which has as much certainty in it as our knowledge itself; and we may as well doubt of our own *being*, as we can whether any *revelation* from *God* be *true*. So that *faith* is a settled and sure principle of *assent* and *assurance*, and leaves no manner of room for doubt or hesitation; only we must be sure, that it be a *divine revelation*, and that we understand it right, else we shall expose ourselves to all the extravagancy of *enthusiasm*, and all the error of wrong principles, if we have *faith* and *assurance* in what is not *divine revelation*.

Of reason.

THE word *reason*, in *English*, has different significations. Sometimes it is taken for *true* and *clear principles*; sometimes for *clear* and *fair deductions* from those principles; sometimes for the *cause*, and particularly for the *final cause*: But the consideration we shall have of it here, is as it stands for a *faculty* whereby *man* is supposed to be distinguished from *beasts*, and wherein it is evident he much surpasses them.

Reason is necessary, both for the enlargement of our knowledge, and regulating our assent; for it hath to do both in knowledge and opinion, and is necessary and assisting to all our other intellectual faculties; and indeed contains *two* of them, *viz.* first, *Sagacity*, whereby it finds intermediate *ideas*; secondly, *Illation*, whereby it so orders and disposes of them, as to discover what connection there is in each link of the chain, whereby the extremes are held together, and thereby, as it were, to draw into view the truth sought for; which is that we call *illation*, or *inference*; and consists in nothing but the perception of the connection there is between the *ideas* in each step of the deduction; whereby the mind comes to see either the certain agreement or disagreement of any

two *ideas*, as in *demonstration*, in which it arrives at knowledge; or their probable connection, on which it gives or with-holds its *assent*, as in *opinion*.

*Sense* and *intuition* reach but a little way: The greatest part of our knowledge depends upon deductions and intermediate *ideas*. In those cases where we must take propositions for true, without being certain of their being so, we have need to find out, examine, and compare the grounds of their *probability*: In both cases, the faculty which finds out the means, and rightly applies them to discover certainty in the one, and probability in the other, is that which we call *reason*: So that in reason we may consider these four degrees; *first*, The discovering and finding out of proofs; *secondly*, The regular and methodical disposition of them, and laying them in such order as their connection may be plainly perceived; *thirdly*, The perceiving their connection; *fourthly*, The making a right conclusion.

There is one thing more which deserves to be considered concerning *reason*; and that is, whether *syllogism*, as is generally thought, be the proper instrument of it; and the usefullest way of exercising this faculty. The causes to doubt of it, are these:

*First*, Because *syllogism* serves our *reason* but in one only of the forementioned parts of it; and that is, to shew the connection of the proofs of any one instance, and no more: But in this it is of no great use, since the mind can perceive such connection, where it really is, as easily, nay perhaps better, without it. We may observe, that there are many men that reason exceeding clear and rightly, who know not how to make a *syllogism*: And scarce any one make *syllogisms* in reasoning within himself. Indeed, sometimes they may serve to discover a fallacy, hid in a *retorical* flourish; or by stripping an absurdity of the cover of wit and good language, shew it in its naked deformity: But the weakness or fallacy of such a loose discourse it shews, by the artificial form it is put into, only to those who have thoroughly studied *mode* and *figure*, and have so examined the many ways that three propositions may be put together, as to know which of them does certainly conclude right, and which not, and upon what grounds it is that they do so: But they who have not so far looked into those forms, are not sure, by virtue of *syllogism*, that the conclusion certainly follows from the premisses; the mind is not taught to reason by these *rules*; it has a native faculty to perceive the coherence or incoherence of its *ideas*, and can range them right without any such perplexing *repetitions*.

And to shew the weakness of an argument, there needs no more but to strip it of the superfluous *ideas*, which, blended and confounded with those on which the inference depends, seem to shew a connection where there is none, or at least do hinder the discovery of the want of it; and then to lay the naked *ideas*, on which the force of the argumentation depends, in their due order; in which position the mind, taking a view of them, sees what connection they have, and so is able to judge of the inference without any need of *syllogism* at all.

*Secondly*, Because *syllogisms* are not less liable to fallacies than the plainer ways of argumentation. And for

this we appeal to common observation, which has always found these artificial methods of reasoning more adapted to catch and entangle the mind, than to instruct and inform the understanding. And if it be certain that fallacy can be couched in *syllogisms*, as it cannot be denied, it must be something else, and not *syllogism*, that must discover them: But if men skilled in and used to *syllogisms*, find them assisting to their reason in the discovery of truth, we think they ought to make use of them. All that we aim at is, that they should not ascribe more to these forms than belongs to them; and think that men have no use, or not so full a use, of their reasoning faculty without them.

But however it be in knowledge, it is of far less, or no use at all in *probabilities*: For the *assent* there being to be determined by the preponderancy, after a due weighing of all the proofs on both sides, nothing is so unfit to assist the mind in that as *syllogism*; which running away with one assumed *probability*, pursues that till it has led the mind quite out of sight of the thing under consideration.

But let it help us (as perhaps may be said) in *convincing men of their errors or mistakes*: yet still it fails our reason in that part, which if not its highest perfection, is yet certainly its hardest task, and that which we most need its help in; and that is, *the finding out of proofs, and making new discoveries*. This way of reasoning discovers no new proofs, but is the art of marshalling and ranging the old ones we have already. A man knows first, and then he is able to prove *syllogistically*; so that *syllogism* comes after knowledge; and then a man has little or no need of it. But it is chiefly by the finding out those *ideas* that shew the connection of distant ones, that our stock of knowledge is increased, and that useful arts and sciences are advanced.

*Reason*, though of a very large extent, fails us in several instances; as, *first*, Where our *ideas* fail. *Secondly*, It is often at a loss, because of the obscurity, confusion, nor imperfection of the *ideas* it is employed about. Thus having no perfect *idea* of the least extension of *matter*, or of *infinity*, we are at a loss about the divisibility of *matter*. *Thirdly*, Our *reason* is often at a stand, because it perceives not those *ideas*, which would serve to shew the certain or probable agreement or disagreement of any two other *ideas*. *Fourthly*, Our *reason* is often engaged in absurdities and difficulties, by proceeding upon false principles, which being followed, lead men into contradictions to themselves, and inconsistency in their own thoughts. *Fifthly*, Dubious words, and uncertain signs, often puzzle mens *reason*, and bring them to a nonplus.

Though the deducing one proposition from another, be a great part of reason, and that which it is usually employed about; yet the principal act of ratiocination, is the finding the agreement or disagreement of two *ideas* one with another, by the intervention of a third; as a man, by a yard, finds two houses to be of the same length, which could not be brought together to measure their equality by *juxta-position*: Words have their consequences as the signs of such *ideas*; and things agree or disagree, as really they are; but we observe it only by our *ideas*.

In reasoning, men ordinarily use *four* sorts of arguments.

The *first* is to alledge the opinions of men, whose parts, learning, eminency, power, or some other cause, has gained a name, and settled their reputation in the common esteem with some kind of authority: This may be called *argumentum ad verecundiam*.

*Secondly*, Another way is, to require the adversary to admit what they alledge as a proof, or to assign a better: This is called *argumentum ad ignorantiam*.

A *third* way, is to press a man with consequences drawn from his own principles or concessions: This is known under the name of *argumentum ad hominem*.

*Fourthly*, The using of proofs drawn from any of the foundations of knowledge or probability: This is called *argumentum ad iudicium*. This alone, of all the four, brings true instruction with it, and advances us in our way to knowledge: For, *first*, It argues not another man's opinion to be right, because I, out of respect, or any other consideration but that of conviction, will not contradict him. *Secondly*, It proves not another man to be in the right way, nor that I ought to take the same with him, because I know not a better. *Thirdly*, Nor does it follow, that another man is in the right way, because he has shewn me that I am in the wrong: This may dispose me, perhaps, for the reception of truth, but helps me not to it: that must come from *proofs and arguments*, and light arising from the nature of things themselves; not from my shame-facedness, ignorance, or error.

By what has been said of *reason*, we may be able to make some guess at the distinction of things into those that are according to, above, and contrary to *reason*. According to *reason*, are such propositions whose truth we can discover by examining and tracing those ideas we have from *sensation and reflection*, and by natural deduction find to be true or probable. Above *reason*, are such propositions, whose truth or probability we cannot by *reason* derive from those principles. Contrary to *reason*, are such propositions as are inconsistent with, or irreconcilable to our clear and distinct ideas. Thus the *existence of one God*, is according to *reason*; the *existence of more than one God*, contrary to *reason*; the *resurrection of the body after death*, above *reason*. Above *reason*, may be also taken in a double sense, *viz.* Above probability; or, above certainty: In that large sense also, contrary to *reason* is sometimes taken.

There is another use of the word *reason*, wherein it is opposed to *faith*; which, though authorized by common use, yet is it in itself a very improper way of speaking; for *faith* is nothing but a firm assent of the mind; which, if it be regulated as is our duty, cannot be afforded to any thing but upon good *reason*, and so cannot be opposite to it: He that believes without having any reason for believing, may be in love with his own fancies; but neither seeks truth as he ought, nor pays the obedience due to his Maker, who would have him use those discerning faculties he has given him, to keep him out of mistake and error.

M E T

M E T

METAPLASMUS, in grammar, a transmutation or change made in a word, by adding, retrenching, or altering a letter or syllable thereof.

METASTASIS, in medicine, a transposition or settlement of some humour or disease on some other part; and sometimes it signifies such an alteration of a disease as is succeeded by a solution.

METATARSUS, in anatomy See ANATOMY, p. 187.

METATHESIS, in grammar, a species of the metaphlasmus; being a figure whereby the letters or syllables of a word are transposed, or shifted out of their usual situation, as *piltris* for *pristis*.

METEMPSYCHOSIS, the doctrine of transmigration, which supposes that human souls, upon leaving the body, become the souls of such kind of brutes as they most resemble in their manners.

This was the doctrine of Pythagoras and his followers; who, held that the souls of vicious men were imprisoned in the bodies of miserable beasts there to do penance for several ages, at the expiration whereof they returned again to animate men; but if they had lived virtuously, some happier brute, or even a human creature, was to be their lot. What led Pythagoras to this opinion was the persuasion he had that the soul was not of a perishable nature; when he concluded, that it must move into some other body upon its abandoning this. Lucan thinks the doctrine was

contrived to mitigate the apprehension of death, by persuading men that they only changed their lodgings, and ceased to live only to begin a new life.

METEMTOSIS, a term in chronology, expressing the solar equation, necessary to prevent the new moon from happening a day too late; by which it is opposed to proemptions, which signifies the lunar equation necessary to prevent the new moon from happening a day too soon.

METEOR, in physiology, an imperfect, changeable, and mixt body, or the resemblance of a body appearing in the atmosphere, and formed by the action of the heavenly bodies, out of the common elements.

Meteors are of three kinds; fiery, airy, and watery. Fiery meteors consist of a fat sulphureous smoke set on fire; such as falling stars, draco volans, the ignis fatuus, and other phænomena, appearing in the air. Airy meteors consist of flatulent and spirituous exhalations, such as winds, &c. Watery meteors are composed of vapours, or watery particles, variously modified by heat and cold, such as clouds, rain, hail, snow and dew.

METHEGLIN, a drink prepared of honey, one of the most pleasant and general drinks the northern parts of Europe afford. It is, according to Bailey, made as follows: Put as much new honey naturally running from the comb, into spring water, as that, when the honey is thoroughly dissolved, an egg will not sink to the bottom, but be just suspended in it. Then boil the liquor for

for an hour or more, till such time as the egg swim above the liquor; then take it off the fire, and let it cool. When very cool, next morning, it may be barrelled up; and adding to it half an ounce of ginger, as much of cloves, as much of mace, and a quarter of an ounce of cinnamon, all grossly pounded, a spoonful of yeast may be added also at the bung to increase its fermentation. When it has done working, it may be closely stopped up; and after it has stood a month, it may be drawn off into bottles.

**METHOD**, the arrangement of our ideas in such a regular order, that their mutual connection and dependence may be readily comprehended.

**METHODISTS**, a name at first given to a society of religious young men at Oxford, and now applied to all those who adhere to the doctrine of the church of England as taught by Whitefield, Wesley, &c. They are said to be, in general, plain well-meaning people, who do not dissent from the established church; but profess to live with great purity, according to her articles. At their first appearance their teachers were charged, in the heat of their zeal, with several irregularities, and many expressions in their preaching which were not altogether unexceptionable; but as the civil government, with a moderation and wisdom peculiar to the present time, thought fit to overlook their behaviour, they have since honestly acknowledged wherein they were mistaken; and, in consequence of the perfect liberty of conscience they enjoy, have subsided into a more regular and peaceable conduct, agreeable to the genuine spirit of Christianity.

**METHODISTS**, *Methodici*, is also an appellation given to a sect of ancient physicians, who reduced the whole healing art to a few common principles or appearances.

**METONYMY**, in rhetoric, is a trope in which one name is put for another, on account of the near relation there is between them. By this trope any of the most significant circumstances of a thing are put for the thing itself. The metonymy is used with most advantage in the following cases. 1. When the narration stands for the action, and what the poet or historian describes he is said to do; which is a lively manner of expression, exceeding the common, as much as action goes beyond description, or life excels painting. 2. When the name of any relation is put for the duty it requires, and the benevolence and tenderness that may be expected from it. Thus Anacreon says, that through money there is no longer any such thing as brethren or parents in the world. 3. When the word which is used for a proper name, is either taken from the person's country, family, profession, personal circumstance, or resemblance to some other: thus, as Sardanapalus was a monster of debauchery, and Nero of cruelty, to call a very debauched person a Sardanapalus, and a cruel one Nero, brands them much deeper than to call one debauched, and the other cruel.

**METOPE**, in architecture, is the interval, or square space between the triglyphs of the doric frieze, which among the ancients used to be painted or adorned with carved work, representing the heads of oxen, or utensils used in sacrifices.

**METOPOSCOPY**, the pretended art of knowing a person's disposition and manners, by viewing the traces and lines in the face.

**METRE**, in poetry, a system of feet of a just length.

The different metres in poetry, are the different manners of ordering and combining the quantities, or the long and short syllables; thus hexameter, pentameter, iambic, sapphic verses, &c. consist of different metres, or measures.

In English verses, the metres are extremely various and arbitrary, every poet being at liberty to introduce any new form that he pleases. The most usual are the heroic, generally consisting of five long and five short syllables, and verses of four feet, and of three feet and a cæsure or single syllable.

**METRETES**, an ancient measure of capacity, containing a little more than nine gallons.

**METROPOLIS**, the capital or principal city of a country or province.

The term metropolis is also applied to archiepiscopal churches, and sometimes to the principal or mother church of a city.

**METZ**, a city of Germany, in the duchy of Lorraine, capital of the bishoprick of Metz, situated thirty miles north of Nancy.

**MEXICO**, the metropolis of New Spain at present, and formerly of the empire of Mexico, situated in W. long.  $-103^{\circ}$ . N. lat.  $20^{\circ}$ .

This province of New Spain in America is now divided into Old and New Mexico.

**Old MEXICO**, situated between  $83$  and  $116$  degrees of W. long. and between  $8$  and  $28$  degrees N. lat. is bounded by New Mexico, or Granada, on the north; by the gulph of Mexico, on the north-east; by Terra-firma, on the south-east; and by the Pacific Ocean, on the south-west.

**New MEXICO**, including California, situated between  $100$  and  $140$  degrees of W. long. and between the Tropic of Cancer and  $48$  degrees of N. lat. is bounded by unknown lands on the north, by Florida on the east, by Old Mexico on the south, and by the Pacific Ocean on the west.

**MEZZOTINTO**, a particular manner of representing figures on copper, so as to form prints in imitation of painting in Indian ink.

The manner of making mezzotintos is very different from all other kinds of engraving and etching, since instead of forming the figures with lines and scratches made with the point of a graver, or by means of aquafortis, they are wholly formed by scraping and burnishing. Mezzotintos are made in the following manner: take a well-polished copper-plate, and beginning at the corner, rake or furrow the surface all over with a knife or instrument made for the purpose, first one way, and then the other, till the whole is of a regular roughness, without the last smooth part to be seen; in which state, if a paper was to be worked off from it at the copper-plate press, it would be all over black. When this is done, the plate is rubbed over with charcoal, black chalk, or black lead, and then the design is drawn with white chalk; after which the cut-lines are traced

out,

out, and the plate finished by scraping off the roughness, so as to leave the figure on the plate. The outlines and deepest shades are not scraped at all, the next shades are scraped but little, the next more, and so on, till the shades gradually falling off, leave the paper white, in which the places the plate is neatly burnished.

By an artful disposition of the shades, and different parts of a figure on different plates, mezzotintos have been printed in colours, so as nearly to represent very beautiful paintings.

MIASMA, among physicians, denotes the contagious effluvia of pestilential diseases, whereby they are communicated to people at a distance.

MICA, GLIMMER, in natural history, a genus of talcs.

The bright appearance of the gold and silver glimmers, has led some to imagine they were gold and silver ores; but the truth is, they contain not the least grain of either of these metals, being mere talc, accidentally coloured. See TALC.

MICAH, or the *book of MICAH*, a canonical book of the Old Testament, written by the prophet Micah, who is the seventh of the twelve lesser prophets. He is cited by Jeremiah, and prophesied in the days of Jotham, Ahaz, and Hezekiah. He censures the reigning vices of Jerusalem and Samaria, and denounces the judgments of God against both kingdoms. He likewise foretells the confusion of the enemies of the Jews, the coming of the Messiah, and the glorious success of his church.

MICHAELMAS, or *feast of St MICHAEL and all angels*, a festival of the Christian church, observed on the 29th of September.

MICHELLIA, in botany, a genus of the polyandria polygynia class. The calix consists of eight segments, and the corolla of eight petals; and the berries contain many seeds. There is but one species, a native of India.

MICROCOSM, in botany, a genus of the polyandria mo-

nogynia class. The calix consists of five leaves, and the corolla of five petals. There are two species, both natives of India.

MICROCOSM, a Greek term, signifying the little world; used by some for man, as being supposed an epitome of the universe or great world.

MICROGRAPHY, the description of objects too minute to be viewed without the assistance of a microscope. See MICROSCOPE.

MICROMETER, a machine, which, by means of a screw, serves to measure extremely small distances to a great degree of accuracy.

MICROPUS, in botany, a genus of the syngenesia polygama segregata class. The receptacle is paleaceous; it has no pappus; and the corolla have no radii. There are two species, none of them natives of Britain.

MICROSCOPE, an optical instrument, by means whereof very minute objects are represented. See OPTICS.

MIDAS-EAR-SHELL, the smooth ovato-oblong buccinum, with an oblong and very narrow mouth. It consists of six volutions, but the lower one alone makes up almost the whole shell.

MID-HEAVEN, the point of the ecliptic that culminates, or in which it cuts the meridian,

MIDDLEBURG, the capital city of Zealand, one of the United Provinces, situated in the island of Welcherin, twenty-six miles north-east of Bruges.

MIDDLESEX, a county of England, in which London, the metropolis, stands. It is twenty four miles long, and only fourteen broad; and is bounded by Hertfordshire, on the north; by the river Lea, which divides it from Essex, on the east; by the river Thames, which separates it from Surry, on the south; and by the brook Coln, which divides it from Buckinghamshire, on the west.

MIDHURST, a borough-town of Suffex, ten miles north of Chichester; which sends two members to parliament.

## M I D W I F E R Y .

**M**IDWIFERY is the art of assisting nature in bringing forth a perfect foetus, or child, from the womb of the mother.

The knowledge of this art depends greatly on an intimate acquaintance with the anatomy of the parts of generation in women, both internal and external. But, as those have already been fully described under the article ANATOMY, we must refer to the different parts of that science upon which the knowledge of midwifery depends.

For the BONES of the PELVIS, see ANATOMY, p. 171, &c.

For the PARTS of GENERATION in FEMALES, both external and internal, see ANATOMY, p. 274, &c.

For the different theories of CONCEPTION, see GENERATION.

*Of the increase of the UTERUS after conception.*

It is supposed, that the ovum swims in a fluid, which

it absorbs so as to increase gradually in magnitude, till it comes in contact with all the inner surface of the fundus uteri; and this being distended in proportion to the augmentation of its contents, the upper part of the neck begins also to be stretched.

About the third month of gestation, the ovum in bigness equals a goose egg; and then nearly one fourth of the neck, at its upper part, is distended equal with the fundus. At the fifth month, the fundus is increased to a much greater magnitude, and rises upwards to the middle space betwixt the upper part of the pubes and the navel; and at that period, one half of the neck is extended. At the seventh month, the fundus reaches as high as the navel; at the eighth month, it is advanced midway between the navel and *scrobiculus cordis*; and in the ninth month, is raised quite up to this last mentioned part, the neck of the womb being then altogether distended. See Plate CXI. fig. 1, 2, 3.

FIG. 1. Gives a front-view of the uterus *in situ* suspended in the vagina; the anterior parts of ossa ischiium, with the ossa pubis, pudenda, perinæum, and anus, being removed in order to shew the internal parts.

- A, The last vertebra of the loins.
- BB, The ossa ilium.
- CC, The acetabula.
- DD, The inferior and posterior parts of the ossa ischiium.
- E, The part covering the extremity of the coccyx.
- F, The inferior part of the rectum.
- GG, The vagina cut open longitudinally, and stretched on each side of the collum uteri, to shew in what manner the uterus is suspended in the same.
- HH, Part of the vesica urinaria stretched on each side of the vagina, and inferior part of the fundus uteri.
- I, The collum uteri.
- K, The fundus uteri.
- LL, The tubi Fallopiiani and fimbriæ.
- MM, The ovaria.
- NN, The ligamenta lata and rotunda.
- OO, The superior part of the rectum.

FIG. 2. Gives a front-view of the uterus in the beginning of the first month of pregnancy; the anterior part being removed that the embryo might appear through the amnios, the chorion being dissected off.

- A, The fundus uteri.
- B, The collum uteri, with a view of the rugous canal that leads to the cavity of the fundus.
- C, The os uteri.

FIG. 3. In the same view and section of the parts as in fig. 1. shews the uterus as it appears in the second or third month of pregnancy.

- F, The anus.
- G, The vagina, with its plicæ.
- HH, The posterior and inferior part of the urinary bladder extended on each side; the anterior and superior part being removed.
- II, The mouth and neck of the womb, as raised up when examining the same by the touch, with one of the fingers in the vagina.
- KK, The uterus as stretched in the second or third month, containing the embryo, with the placenta adhering to the fundus.

Now that the whole substance of the uterus is stretched, the neck and os internum, which were at first the strongest, become the weakest part of the womb, and the stretching force being still continued by the increase of the fœtus and secundines, which are extended by the inclosed waters in a globular form, the os uteri begins gradually to give way. In the beginning of its dilatation, the nervous fibres in this place, being more sensible than any other part of the uterus, are irritated, and yield an uneasy sensation; to alleviate which, the woman squeezes her uterus, by contracting the abdominal muscles, and at the same time filling the lungs with air, by which the diaphragm is kept down; the pain being rather increased than abated by this straining, is communicated to all the neighbouring parts, to which the ligaments and vessels are

attached, such as the back, loins, and inside of the thighs; and by this compression of the uterus, the waters and membranes are squeezed against the os uteri, which is, of consequence, a little more opened. See fig. 4, 5, 6. of Plate CXL.

FIG. 4. In the same view and section of the parts with the former figures, represents the uterus in the eighth or ninth month of pregnancy.

A, The uterus as stretched to near its full extent, with the waters, and containing the fœtus entangled in the funis, the head presenting at the upper part of the pelvis.

BB, The superior part of the ossa ilium.

CC, The acetabula.

DD, The remaining posterior parts of the ossa ischiium.

E, The coccyx.

F, The inferior part of the rectum.

GGG, The vagina stretched on each side.

H, The os uteri, the neck being stretched to its full extent or entirely obliterated.

II, Part of the vesica urinaria.

KK, The placenta, at the superior and posterior part of the uterus.

LL, The membranes.

M, The funis umbilicalis.

FIG. 5. Gives a front view of twins *in utero* in the beginning of labour.

A, The uterus as stretched, with the membranes and waters.

BB, The superior parts of the ossa ilium.

CC, The acetabula.

DD, The ossa ischiium.

E, The coccyx.

F, The lower part of the rectum.

GG, The vagina.

H, The os internum stretched open about a finger-breadth, with the membranes and waters in time of labour-pains.

II, The inferior part of the uterus, stretched with the waters, which are below the head of the child that presents.

KK, The two placentas adhering to the posterior part of the uterus, the two fœtus's lying before them, one with its head in a proper position at the inferior part of the uterus, and the other situated preternaturally with the head to the fundus: the bodies of each are here entangled in their proper funis, which frequently happens in the natural as well as preternatural positions.

LLL, The membranes belonging to each placenta.

FIG. 6. Shews, in a lateral view and longitudinal division of the parts, the gravid uterus when labour is somewhat advanced.

A, The lowest vertebra of the back; the distance from which to the last mentioned vertebra is here shewn by dotted lines.

CC, The usual thickness and figure of the uterus when extended by the waters at the latter end of pregnancy.

D, The



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



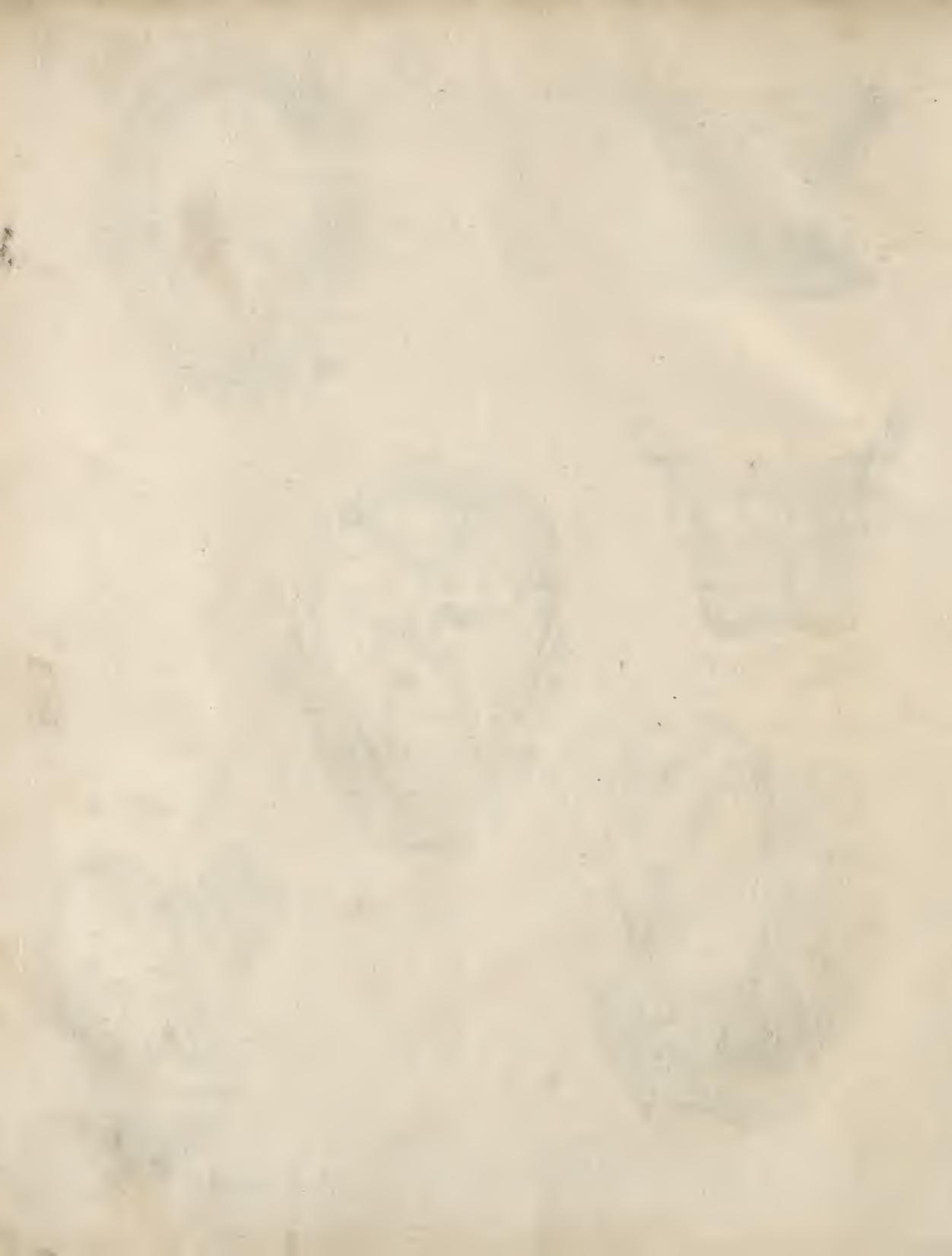
Fig. 5.

Fig. 6.



Fig. 7.

J. Bell Sculp.



- D, The same contracted and grown thicker after the waters are evacuated.  
 EE, The figure of the uterus when pendulous.  
 FF, The figure of the uterus when stretched higher than usual, which generally occasions vomitings and difficulty of breathing.  
 G, The os pubis of the left side.  
 HH, The os internum.  
 I, The vagina.  
 K, The left nympha.  
 L, The labium pudendi of the same side.  
 M, The remaining portion of the bladder.  
 N, The anus.  
 OP, The left hip and thigh.

The woman being unable to continue this effort, for any length of time, from the violence of the pain it occasions, and the strength of the muscles being thereby a little exhausted and impaired, the contracting force abates; the tension of the os tincæ being taken off, it becomes more soft, and contracts a little; so that the nervous fibres are relaxed. This remission of pain the patient enjoys for some time, until the same increasing force renews the stretching pains, irritation, and something like a teneffmus at the os uteri; the compression of the womb again takes place, and the internal mouth is a little more dilated, either by the pressure of the waters and membranes, or when the fluid is in small quantity, by the child's head forced down by the contraction of the uterus, which in that case is in contact with the body of the foetus. See Plate CXI. where

FIG. 7. Shews the forehead of the foetus turned backwards to the os sacrum, and the occiput below the pubes, by which means the narrow part of the head is to the narrow part of the pelvis, that is, between the inferior parts of the ossa ischium.

- A, The uterus contracted closely to the foetus after the waters are evacuated.  
 BCD, The vertebræ of the loins, os sacrum, and coccyx.  
 E, The anus.  
 F, The left hip.  
 G, The perinæum.  
 H, The os externum beginning to dilate.  
 I, The os pubis of the left side.  
 K, The remaining portion of the bladder.  
 L, The posterior part of the os uteri.

In this manner the labour pains begin, and continue to return periodically, growing stronger and more frequent, until the os uteri is fully dilated, and the membranes are depressed and broke; so that the waters are discharged, the uterus contracts, and, with the assistance of the muscles, the child is forced along and delivered.

#### Of ABORTIONS.

A MISCARRIAGE that happens before the tenth day, was formerly called an efflux, because the embryo and secundines are not then formed, and nothing but the liquid conception, or genitura, is discharged. From the tenth day to the third month it was known by the term expulsiō, the embryo and secundines being still so small,

that the woman is in no great danger from violent flooding.

If she parted with her burden betwixt that period and the seventh month, she was said to suffer an abortion; in which case she underwent greater danger, and was delivered with more difficulty than before: because the uterus and vessels being more distended, a larger quantity of blood was lost in a shorter time, the foetus was increased in bulk, and the neck of the womb is not yet fully stretched: besides, should the child be born alive, it will be so small and tender that it will not suck, and scarce receive any sort of nourishment.

When delivery happens between the seventh month and full time, the woman is said to be in labour: but, instead of these distinctions, if she loses her burden at any time from conception to the seventh or eighth, or even in the ninth month, we now say indiscriminately, she has miscarried.

The common term of pregnancy is limited to nine solar months, reckoning from the last discharge of the catamenia: yet in some, though very few, uterine gestation exceeds that period.

#### Of false CONCEPTIONS and MOLES.

IT was formerly supposed, that if the parts of the embryo and secundines were not separated and distinctly formed from the mixture of the male and female semen, they formed a mass, which, when discharged before the fourth month, was called a false conception; if it continued longer in the uterus, so as to increase in magnitude, it went under the denomination of a *mola*. But these things are now to be accounted for in a more probable and certain manner. Should the embryo die (suppose in the first or second month,) some days before it is discharged, it will sometimes be entirely dissolved; so that, when the secundines are delivered, there is nothing else to be seen. In the first month, the embryo is so small and tender, that this dissolution will be performed in twelve hours: in the second month, two, three, or four days will suffice for this purpose; and even in the third month, it will be dissolved in fourteen or fifteen: besides the blood frequently forms thick laminæ round the ovum, to the surface of which they adhere so strongly, that it is very difficult to distinguish what part is placenta, and what membrane. Even after the embryo and placenta are discharged, in the second or third month, the mouth and neck of the womb are often so closely contracted, that the fibrous part of the blood is retained in the fundus, sometimes to the fifth or seventh day; and when it comes off, exhibits the appearance of an ovum, the external surface, by the strong pressure of the uterus, resembling a membrane; so that the whole is mistaken for a false conception.

This substance, in bigness, commonly equals a pigeon or hen egg; or if it exceeds that size, and is longer retained, is distinguished by the appellation of *mola*: but this last generally happens in women betwixt the age of forty-five and fifty, or later, when their menses begin to disappear; sometimes from internal or external accidents that may produce continued floodings. If the catamenia have

have ceased to flow for some time in elderly women, and return with pain, such a symptom is frequently the forerunner of a cancer; before or after this happens, sometimes a large flesh-like substance will be discharged with great pain, resembling that of labour; and upon examination, appears to be no more than the fibrous part of the blood, which assumes that form by being long pressed in the uterus or vagina.

In this place, it will not be amiss to observe, that the glands of the uterus and vagina will sometimes increase, and distend the adjacent parts to a surprising degree; if (for example) one of the glands of the uterus be so obstructed as that there is a pressure on the returning vein and excretory duct, the arterial blood will gradually stretch the smaller vessels, and consequently increase the size of the gland, which will grow larger and larger, as long as the force of the impelled fluid is greater than the resistance of the vessels that contain it; by which means, a very small gland will be enlarged to a great bulk, and the uterus gradually stretched as in uterine gestation, though the progress may be so slow as to be protracted for years instead of months. Nevertheless, the os internum will be dilated, and the gland (if not too large to pass) will be squeezed into the vagina, provided it adheres to the uterus, by a small neck; nay, it will lengthen more and more, so as to appear on the outside of the os externum; in which case, it may be easily separated by a ligature. This disease will be the sooner known and easier remedied, the lower its origin in the uterus is. But should the gland take its rise in the vagina, hard by the mouth of the womb, it will shew itself still sooner, and a ligature may be easily introduced, provided the tumour is not so large as to fill up the cavity and hinder the neck of it from being commodiously felt. Though the greatest difficulty occurs, when the gland is confined to the uterus, being too much enlarged to pass through the os internum.

Sometimes all, or most of the glands in the uterus, are thus affected, and augment the womb to such a degree, that it will weigh a great many pounds, and the woman is destroyed by its pressure upon the surrounding parts; but, should this indolent state of the tumour be altered by any accident that will produce irritation and inflammation, the parts will grow scirrhus, and a cancer ensue.

This misfortune, for the most part, happens to women, when their menstrual evacuations leave them; and sometimes (though seldom) to child bearing women, in consequence of severe labour.

#### *Of the PLACENTA.*

THE OVUM is formed of the placenta with the chorion and amnion, which are globularly distended by the included waters that surround the child. The placenta is commonly of a round figure, somewhat resembling an oat-cake, about six inches in diameter, and one inch thick in the middle, growing a little thinner towards the circumference: it is composed of veins and arteries, which are divided into an infinite number of small branches, the venous parts of which unite in one large tube, called the umbilical vein, which brings back the blood, and is supposed to carry along the nutritive fluid from the vessels of the chorion and placenta, to the child, whose belly it

perforates at the navel; from thence passing into the liver, where it communicates with the vena portarum and cava. It is furnished with two arteries, which arise from the internal iliacs of the child, and running up on each side of the bladder, perforates the belly where the umbilical vein entered; then they proceed to the placenta, in a spiral line, twining round the vein, in conjunction with which they form the funiculus umbilicalis, which is commonly four or five hand-breadths in length, sometimes only two or three, and sometimes it extends to the length of eight or ten. The two arteries, on their arrival at the inner surface of the placenta, are divided and subdivided into minute branches, which at last end in small capillaries that inosculate with the veins of the same order. These arteries, together with the umbilical vein, are supposed to do the same office in the placenta which is afterwards performed in the lungs by the pulmonary artery and vein, until the child is delivered and begins to breathe: and this opinion seems to be confirmed by the following experiments. If the child and placenta are both delivered suddenly, or the last immediately after the first; and if the child, though alive, does not yet breathe; the blood may be felt circulating, sometimes slowly, at other times with great force, through the arteries of the funis to the placenta, and from thence back again to the child, along the umbilical vein. When the vessels are slightly pressed, the arteries swell between the pressure and the child, while the vein grows turgid between that and the placenta, from the surface of which no blood is observed to flow, although it be lying in a basin, among warm water. As the child begins to breathe, the circulation, though it was weak before, immediately grows stronger and stronger, and then in a few minutes the pulsation in the navel-string becomes more languid, and at last entirely stops. If, after the child is delivered, and the navel string cut, provided the placenta adheres firmly to the uterus, which is thereby kept extended; or, if the womb is still distended by another child; no more blood flows from the umbilical vessels, than what seemed to be contained in them at the instant of cutting; and this, in common cases, does not exceed the quantity of two or three ounces; and finally, when, in consequence of violent floodings, the mother expires, either in time of delivery, or soon after it, the child is sometimes found alive and vigorous, especially if the placenta is found; but if torn, then the child will lose blood as well as the mother.

The external surface of the placenta is divided into several lobes, that it may yield and conform itself more commodiously to the inner surface of the uterus, to which it adheres, so as to prevent its being separated by any shock or blows upon the abdomen, unless when violent.

Those groups of veins and arteries which enter into the composition of the placenta receive external coats from the chorion, which is the outward membrane of the ovum, thick and strong, and forms three fourths of the external globe that contains the waters and the child; the remaining part being covered by the placenta; so that these two in conjunction constitute the whole external surface of the ovum. Some indeed alledge, that these are enveloped with a cribriform or cellular substance, which

which they seem to adhere by contact only, to the uterus; and that the inner membrane of the womb is full of little glands, whose excretory ducts opening into the fundus and neck, secrete a soft thin mucus, to lubricate the whole cavity of the uterus, which beginning to stretch in time of gestation, the vessels that compose these glands are also distended; consequently, a greater quantity of this mucus is separated and retained in this cribriform and cellular substance, the absorbing vessels of which take it in, and convey it along the veins, for the nourishment of the child. The womb being therefore distended in proportion to the increase of the child, those glands are also proportionably enlarged; by which means, a larger quantity of the fluid is separated, because the nutriment of the child must be augmented in proportion to the progress of its growth; and this liquor undergoes an alteration in quality as well as in quantity, being changed from a clear thin fluid into the more viscous consistence of milk. In some cases this mucus hath been discharged from the uterus in time of pregnancy, and both mother and child weakened by the evacuation, which may be occasioned by the chorion's adhering too loosely, or being in one part actually separated from the womb.

Formerly, it was taken for granted by many, that the placenta always adhered to the fundus uteri; but this notion is refuted by certain observations, in consequence of which we find it as often sticking to the sides, back and fore parts, and sometimes as far down as the inside of the os uteri. See Plate CXI.

When the placenta is delivered, and no other part of the membrane tore except that through which the child passed, the opening is near the edge or side of the placenta, and seldom in the middle of the membranes; and a hog's bladder being introduced at this opening, and inflated, when lying in water, will shew the shape and size of the inner surface of the womb, and plainly discover the part to which the placenta adhered.

The chorion is, on the inside, lined with the amnion, which is a thin transparent membrane, without any vessels so large as to admit the red globules of blood; it adheres to the chorion by contact, and seems to form the external coat of the funis umbilicalis.

This membrane contains the serum, in which the child swims: which fluid is supposed to be furnished by lymphatic vessels that open into the inner surface of the amnion. If this liquid is neither absorbed into the body of the fœtus, nor taken into the stomach by suction at the mouth, there must be absorbing vessels in this membrane, in the same manner as in the abdomen and other cavities of the body, where there is a constant renovation of humidity.

The quantity of this fluid, in proportion to the weight of the fœtus, is much greater in the first than in the last month of gestation, being in the one perhaps ten times the weight of the embryo; whereas, in the other, it is commonly in the proportion of one to two: for, six pounds of water surrounding a fœtus that weighs twelve pounds, is reckoned a large proportion, the quantity being often much less; nay, sometimes there is very little or none at all.

In most animals of the brute species, there is a third membrane called allantois, which resembles a long and

wide blind-gut, and contains the urine of the fœtus: it is situated between the chorion and amnion, and communicates with the urachus that rises from the fundus of the bladder, and runs along with the umbilical vessels, depositing the urine in this reservoir, which is attached to its other extremity. This bag hath not yet been certainly discovered in the human fœtus, the urachus of which, though plainly perceivable, seems hitherto to be quite imperforated.

From the foregoing observations upon nutrition, it seems probable, that the fœtus is rather nourished by the absorption of the nutritive fluid into the vessels of the placenta and chorion, than from the red blood circulated in full stream from the arteries of the uterus to the veins of the placenta, and returned by the arteries of the last to the veins of the first, in order to be renewed, refined, and made arterial blood in the lungs of the mother.

#### *Of the CHILD'S situation in the UTERUS.*

THE embryo or fœtus, as it lies in the uterus, is nearly of a circular or rather oval figure, which is calculated to take up as little space as possible: the chin rests upon the breasts, the thighs are pressed along the belly, the heels applied to the breech, the face being placed between the knees, while the arms cross each other round the legs. The head, for the most part, is down to the lower part of the uterus; and the child being contracted into an oval form, the greatest length is from head to breech: but the distance from one side to the other is much less than that from the fore to the back part; because the thighs and legs are doubled along the belly and stomach, and the head bended forwards on the breast. The uterus being confined by the vertebræ of the loins, the distance from the back to the fore-part of it must be less than from side to side; so that, in all probability, one side of the fœtus is turned towards the back, and the other to the fore-part of the womb: but, as the back part of the uterus forms a little longish cavity on each side of the vertebræ, the fore-parts of the fœtus may therefore for the most part tilt more backwards than forwards.

It has been generally supposed, that the head is turned up to the fundus, and the breech to the os uteri, with the fore-parts towards the mother's belly; and that it remains in this situation till labour begins, when the head comes downwards, and the face is turned to the back of the mother. Some alledge, that the head precipitates about the end of the eighth or beginning of the ninth month, by becoming specifically heavier than the rest of the body. Others affirm, that as the child increases in bulk, especially during the two last months, the proportion of surrounding water must be diminished, so as that it is confined in its motion, and, in struggling to alter its position, the head is moved to the os tunicæ, where it remains till delivery. The particulars of this and other theories may be found in *Mauriceau, Le Motte, Simpson, and Old*. But, from the following observations, it seems more probable, that the head is, for the most part, turned down to the lower part of the uterus from conception to delivery.

In the first month, according to some writers, the em-

bryo exhibits the figure of a tadpole, with a large head and small body or tail, which gradually increases in magnitude, till the arms and thighs begin to bud or strut out, like small nipples, from the shoulders and breech: two black specks appear on each side of the head, with a little hole or opening between them, which in the second month are easily distinguished to be the eyes and mouth. See Plate CXI. fig. 2. The legs and arms are gradually formed, while the body turns larger; but the fingers are not separated or distinct, till the latter end of the second or beginning of the third month. See Plate CXI. fig. 3. This is commonly the case; but sometimes the bulk and appearance differ considerably in different embryos of the same age. The younger the embryo, the larger and heavier is the head in proportion to the rest of the body; and this is the case in all the different gradations of the fœtus; so that when dropt or suspended by the navel string in water, the head must sink lowermost of course. Besides, when women miscarry in the fourth, fifth, sixth, and seventh months, the head for the most part presents itself, and is first delivered. See Plate CXI. fig. 3. By the touch in the vagina, the head is frequently felt in the seventh, sometimes in the sixth, but more frequently in the eighth month; and if the same women are thus examined, from time to time, till the labour begins, the head will always be felt of a round firm substance at the fore-part of the brim of the pelvis, betwixt the os internum and pubes, through the substance of the vagina and uterus. See Plate CXI. fig. 4. But all those opinions are liable to objections. If the descent of the head proceeded from its specific gravity, we would always find it at the os internum, because this reason would always prevail; if it were owing to a diminished proportion of water, why should we often find the breech presented, even when there is a quantity of that fluid large enough to give the head free liberty to rise again towards the fundus, or (according to the other opinion) to sink down by its specific gravity to the os internum? Some, indeed, suppose, that the head always presents itself, except when it is hindered by the funis umbilicalis twisting round the neck and body, so as to impede the natural progress: but, were this supposition just, when we turn and deliver by the feet those children that presented in a preternatural way, we should always find them more or less circumvoluted by the navel-string: the funis is as often found twisted round the neck and body when the head presents as in any other case. That the head is downwards all the time of gestation, seems, on the whole, to be the most reasonable opinion, though it be liable to the objection already mentioned, and seems contradictory to the observation of some authors, who allege, that in opening women that died in the fifth, sixth, or seventh month, they have found the child's head towards the fundus uteri. But as it lies as easy in one posture as in another, till the birth, this dispute is of less consequence in the practice of midwifery. It may be useful to suggest, that the wrong posture of the child in the uterus may proceed,

1. From circumvolutions in the funis umbilicalis. See Plate CXIII. fig. 1. which represents, in a front view of the pelvis, the breech of the fœtus presenting, and dila-

ting the os internum, the membranes being too soon broke. The fore-parts of the child are to the posterior part of the uterus; and the funis, with a knot upon it, surrounds the neck, arms, and body.

Or, 2. When there is little or no water surrounding the child, it may move into a wrong position, and be confined there by the stricture of the uterus. See Plate CXIII. fig. 2, 3, 4.

FIG. 2. is the reverse of fig. 1. the fore-parts of the child being to the fore-part of the uterus.

FIG. 3. represents, in a front view of the pelvis, the fœtus compressed, by the contraction of the uterus, into a round form, the fore-parts of the former being towards the inferior part of the latter, and one foot and hand fallen down into the vagina. In this figure, the anterior part of the pelvis is removed, by a longitudinal section through the middle of the foramen magnum.

AA, The superior parts of the ossa ilium.

BB, The uterus.

C, The mouth of the womb stretched and appearing in OOOO, The vagina.

D, The inferior and posterior part of the os externum.

EEEE, The remaining parts of the ossa pubis and ischium.

FFFF, The membrana adiposa.

FIG. 4. represents, in the same view with fig. 3. the fœtus in the contrary position; the breech and fore-parts being towards the fundus uteri, the left arm in the vagina, and the fore arm without the os externum, the shoulder being likewise forced into the os uteri.

Or, lastly, The wrong position of the child may be the effect of a pendulous belly or narrow pelvis, when the head lies forward over the pubis. See Plate CXI. fig. 6. See also Plate CXII. fig. 6. and 7.

FIG. 6. gives a lateral internal view of a distorted pelvis, divided longitudinally, with the head of a fœtus of the seventh month passing the same.

ABC, The os sacrum and coccyx.

D, The os pubis of the left side.

E, The tuberosity of the os ischium of the same side.

FIG. 7. gives a side view of a distorted pelvis, divided longitudinally, with the head of a full grown fœtus squeezed into the brim, the parietal bones decussating each other, and compressed into a conical form.

ABC, The os sacrum and coccyx.

D, The os pubis of the left side.

E, The tuberosity of the os ischium.

F, The processus acutus.

G, The foramen magnum.

#### Of TOUCHING.

TOUCHING is performed by introducing the fore-finger lubricated with pomatum into the vagina, in order to feel the os internum and neck of the uterus; and sometimes into the rectum, to discover the stretching of the fundus. By some, we are advised to touch with the middle finger, as being the longest; and by others, to employ both that and the first: but the middle is too much encumbered by that on each side, to answer the purpose fully,

fully; and when two are introduced together, the patient never fails to complain. The design of touching is to be informed whether the woman is, or is not with child; to know how far she is advanced in her pregnancy; if she is in danger of a miscarriage; if the os uteri be dilated; and in time of labour to form a right judgment of the ease, from the opening of the os internum, and the pressing down of the membranes with their waters; and lastly, to distinguish what part of the child is presented.

It is generally impracticable to discover, by a touch in the vagina, whether or not the uterus is impregnated, till after the fourth month: then the best time for examination is the morning, when the woman is fasting, after the contents of the bladder and rectum have been discharged; and she ought, if necessary, to submit to the inquiry in a standing posture; because, in that case, the uterus hangs lower down in the vagina, and the weight is more sensible to the touch than when she lies reclined. One principal reason of our uncertainty is, when we try to feel the neck, the womb rises up on our pressing against the vagina, at the side of the os internum, (see Plate CXI. fig. 3.) and in some, the vagina feels very tense; but, when the fundus uteri is advanced near the navel, the pressure from above keeps down the os internum so much, that you can generally feel both the neck, and, above that, the stretching of the under part of the uterus. See Plate. CXI. fig. 3.

There is no considerable variation to be felt in the figure of the os internum, except in the latter end of pregnancy, when it sometimes grows larger and softer, (see Plate CXI. fig. 4.) nor do the lips seem to be more closed in a woman with child than in another, especially in the beginning of pregnancy: but, in both cases the os uteri is felt like the mouth of a young puppy or tench. In some the lips are very small; in others, large; and sometimes, though seldom, smoothed over or pointed. In many women, who have formerly had children and difficult labours, the lips are large, and so much separated, as to admit the tip of an ordinary finger; but a little higher up, the neck seems to be quite closed.

In the first four months, the neck of the womb may be felt hanging down in the vagina, by pushing up the finger by the side of the os internum; but the stretching of the uterus and upper part of the neck cannot be perceived till the fifth, and sometimes the sixth month; and even then, the uterus must be kept down by a strong pressure upon the belly.

The stretching of the fundus is sometimes felt by the finger introduced into the rectum, before it can be perceived in the vagina; because, in this last method, the uterus recedes from the touch, and rises too high to be accurately distinguished; whereas the finger being introduced into the rectum, passes along the back of the womb almost to the upper part of the fundus, which, in an unimpregnated state, is felt flat on the back part and jetting out at the sides; but the impregnated uterus is perceived like a large round tumour.

About the fifth or sixth month, the upper part of the uterus is so much stretched, as to rise three or four inches above the os pubis, or to the middle space between that and the navel; so that, by pressing the hand on the

belly, especially of lean women, it is frequently perceived; and if, at the same time, the index of the other hand be introduced in the vagina, the neck will seem shortened, particularly at the fore-part and sides, and the weight will be sensibly felt; but, if the parietes of the abdomen are stretched after eating, one may be deceived by the pressure of the stomach, because weight and pressure are the same. But all these signs are more perceptible towards the latter end of pregnancy; and in some women the os internum is felt a little open some weeks before the full time, though generally it is not opened till a few days before labour begins.

From the fifth to the ninth month, the neck of the uterus becomes shorter and shorter, and the stretching of the womb grows more and more perceptible. In the seventh month, the fundus rises as high as the navel; in the eighth month, to the middle space betwixt the navel and scrobiculus cordis; and in the ninth, even to the scrobiculus, except in pendulous bellies; See Plate CXI fig. 4. But all these marks may vary in different women: for when the belly is pendulous, the parts below the navel are much more stretched than those above, and hang over the os pubis; the fundus will then be only equal to, or a little higher than the navel; at other times, the uterus will rise in the latter end of the seventh or eighth month to the scrobiculus cordis. The neck of the womb will, in some, be felt as long in the eighth, as in others in the sixth or seventh month. This variation sometimes makes the examination of the abdomen more certain than the touch of the vagina; and so *vice versa*. At other times we must judge by both. See Plate CXI. fig. 6.

*Of the signs of CONCEPTION, and the equivocal signs of pregnant and obstructed women.*

THE signs of pregnancy are to be distinguished from those that belong to obstructions, by the touch in the vagina and motion of the child, in the fifth or sixth month; sometimes, by the touch in the rectum, before and after the fifth month, when the tumour of the abdomen is plainly perceived.

Most women, a day or two before the irruption of the catamenia, labour under complaints proceeding from a plethora; such as stretching pains in the back and loins, inside of the thighs, breast and head; a sickness and oppression at the stomach, and a fullness of all the viscera of the abdomen; and all these symptoms abate, and gradually vanish, when the discharge begins and continues to flow. But, if the woman be obstructed by any accident or error in the non-naturals, all those complaints continue and increase, and are hardly distinguishable from the symptoms of pregnancy, till the end of the fourth month; at which period, women with child grow better, and all the complaints of fullness gradually wear off; whereas, those who are only obstructed, grow worse and worse. The fundus uteri, in the obstructed patient, is not stretched; the disorder in the stomach is not so violent as in a pregnant woman, and seldom accompanied with reachings; while the women with child is afflicted with a reaching every morning, and subject to longings besides. The first labours under a fullness of the vessels; the last, over and above this complaint, suffers an additional one from  
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the distension of the uterus by the impregnated ovum. Obstructions and pregnancy are both accompanied by a stretching fullness in the breasts; but in the last only, may be perceived the areola, or brown ring, round the nipples, from which, in the last months, a thin serum distills: but this circle is not always so discernible as in the first pregnancy, and even then is uncertain as well as the others.

About the fifth or sixth month, the circumscribed tumour or stretching of the uterus is felt above the os pubis; and, by this circumscription and consistence, easily distinguished from the ascites, or dropsy of the abdomen: it is also rounder and firmer than those swellings that accompany obstructions, which proceed from a general fullness of the vessels belonging to the ligaments and neighbouring viscera.

On the whole, the difficulty of distinguishing between obstructions and pregnancy in the first months, is so great, that we ought to be cautious in giving our opinion; and never prescribe such remedies as may endanger the fruit of the womb; but rather endeavour to palliate the complaints, until time shall discover the nature of the case; and always judge on the charitable side, when life or reputation is at stake.

In the fifth or sixth month of uterine gestation, by the touch in the vagina, we perceive the neck of the womb considerably shortened, and the stretching of the lower part of the uterus is then sensibly felt between the mouth of the womb and the pubes, and on each side of the neck. See Plate CXI. fig. 3.

In the seventh month, the head of the child is frequently felt resting against the lower part of the uterus, between the pubes and os internum; and being pushed upwards towards the fundus, sinks down again by its own gravity. All these diagnostics are more plain and certain, the nearer the patient approaches to the time of delivery.

Sometimes, the head is not felt till the eighth or ninth month; and in some few cases, not till after the membranes are broke, when it is forced down by the contraction of the uterus, and strong labour-pains. This circumstance may be owing to the head's resting above the basin, especially in a narrow pelvis; or to the distension of its belly with air after death, by which the fœtus being rendered specifically lighter than the surrounding waters, the body floats up to the fundus, if there is a large quantity of fluid in the membranes; nor is the body always felt when the child lies across the uterus.

*How to distinguish the false LABOUR from the true, and the means to be used on that occasion.*

If the os uteri remains close shut, it may be taken for granted that the woman is not yet in labour, notwithstanding the pains she may suffer: with regard to which, an accurate inquiry is to be made; and if her complaints proceed from an over stretching fullness of the uterus or vessels belonging to the neighbouring parts, bleeding in the arm or ankle, to the quantity of six or eight ounces, ought to be prescribed, and repeated occasionally. If the pains are occasioned by a looseness or diarrhœa, it must be immediately restrained with opiates. Cholick pains are

distinguished from those of labour, by being chiefly confined to the belly, without going off and returning by distinct intervals: they are for the most part produced by feces too long retained in the colon, or by such ingesta as occasion a rarefaction or expansion of air in the intestines; by which they are violently stretched and vellicated. This complaint must be removed by opening glysters, to empty the guts of their noxious contents: and this evacuation being performed, opiates may be administered to assuage the pains; either to be injected by the anus, taken by the mouth, or applied externally in form of epithem or embrocation.

Sometimes, the os internum may be a little dilated, and yet it may be difficult to judge whether or not the patient be in labour; the case, however, may be ascertained, after some attendance, by these considerations: if the woman is not arrived at her full time; if no soft or glary mucus hath been discharged from the vagina; if the pains are limited to the region of the belly, without extending to the back and inside of the thighs; if they are slight, and continue without intermission or increase; nay, if they have long intervals, and recur without force sufficient to push down the waters and membranes, or child's head, to open the os internum; if this part be felt thick and rigid, instead of being soft, thin, and yielding; we may safely pronounce, that labour is not yet begun; and those alarms are to be removed as we have directed in the case of false or cholick pains. Besides, if the pulse be quick and strong, and the patient attacked by stitches in the sides, back, or head, bleeding will be likewise necessary. See Plate CXI. fig. 4.

#### *The division of LABOURS.*

A NATURAL labour is when the head presents, and the woman is delivered by her pains and the assistance commonly given: but, should the case be so tedious and lingering, that we are obliged to use extraordinary force, in stretching the parts, extracting with the forceps, or (to save the mother's life) in opening the head and delivering with the crotchet, it is distinguished by the appellation of *laborious*: and the *preternatural* comprehends all those cases in which the child is brought by the feet, or the body delivered before the head. Neither do we mind how the child presents, so much as the way in which it is delivered: for there are cases in which the head presents, and for several hours we expect the child will be delivered in the natural way; but if the woman has not strength enough to force down the child's head into the pelvis, or in floodings, we are at length obliged to turn and bring it by the feet, because it is so high that the forceps cannot be applied; and if the child is not large, nor the pelvis narrow, it were pity to destroy the hopes of the parents, by opening the skull and extracting with the crotchet. In this case, therefore, although the child presents in a natural way, we are obliged to turn and deliver it in the same manner as if the shoulder, breast, or back, had presented; and generally, this operation is more difficult than in either of those cases, because, if the waters are all discharged, and the uterus close contracted round the fœtus, it is more difficult to raise the head to the fundus. When the breech presents, we are frequent-

by obliged to push it up, and search for the legs; which being found, we proceed to deliver the body, and lastly the head. If the head is large, or the pelvis narrow, and the waters not discharged, we ought, if possible, to turn the child into the natural position.

For a further illustration, and to inform young practitioners that difficult cases do not frequently occur, suppose, of three thousand women in one town or village, one thousand shall be delivered in the space of one year, and in nine hundred and ninety of these births, the child shall be born without any other than common assistance: fifty children of this number shall offer with the forehead turned to one side, at the lower part of the pelvis, where it will stop for some time; ten shall come with the forehead towards the groin, or middle of the pubes; five shall present with the breech; two or three with the face, and one or two with the ear; yet, all these shall be safely delivered, and the case be more or less lingering and laborious, according to the size of the pelvis and child, or strength of the woman: of the remaining ten that make up the thousand, six shall present with the head differently turned and two with the breech; and these cannot be saved without stretching the parts, using the forceps or crotchet, or pushing up the child in order to bring it by the feet; this necessity proceeding either from the weakness of the woman, the rigidity of the parts, a narrow pelvis, or a large child, &c. the other two should lie across, and neither head nor breech, but some other part of the body, present, so that the child must be turned and delivered by the feet. Next year, let us suppose another thousand women delivered in the same place; not above three, six, or eight, shall want extraordinary assistance; nay, sometimes, though seldom, when the child is young, or unusually small, and the mother has strong pains and a large pelvis, it shall be delivered even in the very worst position, without any other help than that of the labour-pains.

As the head, therefore, presents right in nine hundred and twenty of a thousand labours, all such are to be accounted natural; those of the other seventy, that require assistance, may be deemed laborious; and the other ten to be denominated laborious or preternatural, as they are delivered by the head or feet.

In order, therefore to render this treatise as distinct as possible, for the sake of the reader's memory, as well as of the dependance and connection of the different labours, they are divided in the following manner: that is accounted natural, in which the head presents, and the woman is delivered without extraordinary help; those births are called laborious or nonnatural, when the head comes along with difficulty, and must be assisted either with the hand in opening the parts, or with the fillet or forceps, or even when there is a necessity for opening and extracting it with the crotchet; and those in which the child is brought by the breech or feet, are denominated preternatural, because the delivery is performed in a preternatural way.

#### *Of the different positions of women in Labour.*

IN almost all countries, the woman is allowed either to sit, walk about, or rest upon a bed, until the os uteri

is pretty much dilated by the gravitation of the waters, or (when they are in small quantity) by the head of the fetus, so that delivery is soon expected; when she is put in such position as is judged more safe, easy, and convenient for that purpose: but the patient may be put upon labour too prematurely, and bad consequences will attend such mistakes.

Among the *Egyptians, Grecians, and Romans*, the woman was placed upon an high stool; in Germany and Holland they use the chair which is described by Deventer and Heister; and for hot climates the stool is perfectly well adapted; but in northern countries, and cold weather, such a position must endanger the patient's health.

In the West Indies, and some parts of Britain, the woman is seated on a stool made in form of a femicircle: in other places she is placed on a woman's lap; and some, kneeling on a large cushion, are delivered backwards.

In France the position is chiefly that of half sitting and half lying, on the side or end of a bed; or the woman being in naked bed, is raised up with pillows or a bed-chair.

The London method is very convenient in natural and easy labours; the patient lies in bed upon one side, the knees being contracted to the belly, and a pillow put between them to keep them asunder. But the most commodious method is to prepare a bed and a couch in the same room; a piece of oiled cloth or dressed sheep skin is laid across the middle of each; over the under-sheet, and above this, are spread several folds of linen, pinned or tied with tape to each side of the bed and couch; these are designed to sponge up the moisture in time of labour and after delivery, while the oiled cloths or sheep skins below preserve the feather-bed from being wetted or spoiled: for this purpose, some people lay besides upon the bed several under-sheets over one another, so that by sliding out the uppermost every day, they can keep the bed dry and comfortable.

The couch must be no more than three feet wide, and provided with castors; and the woman without any other dress than that of a short or half shift, a linen skirt or petticoat open before, and a bed-gown, ought to lie down upon it, and be covered with cloaths according to the season of the year. She is commonly laid on the left side, but in that particular she is to consult her own ease; and a large sheet being doubled four times or more, one end must be slipped in below her breech, while the other hangs over the side of the couch, to be spread upon the knee of of the accoucheur or midwife, who sits behind her on a low seat. As soon as she is delivered, this sheet must be removed, a soft warm cloth applied to the os externum, and the pillow taken from betwixt her knees: she then must be shifted with a clean, warm, half shift, linen skirt, and bed-gown, and her belly kept firm with the broad head-band of the skirt, the ends of which are to be pinned across each other. These measures being taken, the couch must be run close to the bed side, and the patient gently moved from one to another; but, if there is no couch, the bed must be furnished with the same apparatus. Some, again, are laid across the foot of the bed, to the head of which the cloaths are previously turned up till after delivery, when the woman's posture is adapted, and then

they are rolled down again to cover and keep her warm : by this expedient, the place of a couch is supplied, and the upper part of the bed preserved soft and clean ; whereas those who are laid above the cloaths must be taken up and shifted while the bed is put to rights ; in which case, they are subject to fainting ; and to such as are very much enfeebled, this fatigue is often fatal.

Women are most easily touched, least fatigued, and kept warmest, when they lie on one side : but if the labour should prove tedious, the Parisian method seems most eligible ; because when the patient half sits, half lies, the brim of the pelvis is horizontal, a perpendicular line falling from the middle space between the scrobiculus cordis and navel, would pass exactly through the middle of the basin. In this position, therefore, the weight of the waters, and, after the membranes are broke, that of the child's head, will gravitate downwards, and assist in opening the parts ; while the contracting force of the abdominal muscles and uterus, is more free, strong, and equal in this than in any other attitude. Wherefore, in all natural cases, when the labour is lingering or tedious, this or any other position, such as standing or kneeling, ought to be tried, which by an additional force, may help to push along the head, and alter its direction when it does not advance in the right way. Nevertheless, the patient must by no means be too much fatigued.

When the woman lies on the left side, the right hand must be used in touching, and *vice versa* ; unless she is laid across the bed ; in which case, either hand will equally answer the same purpose : but, if she lies athwart, with the breech towards the bed's foot, it will be most convenient to touch with the left hand when she is upon the left side, and with the right when in the opposite position. And here it will not be amiss to observe, that in the description of all the laborious and preternatural deliveries treated of in this performance, the reader must suppose the woman lying on her back, except when another posture is prescribed ; and that in natural and laborious labours, whether she be upon her side or back, the head and shoulders are a little raised into a reclining posture, so that she may breathe easily, and assist the pains.

But in preternatural labours, when there is a necessity for using great force in turning the child, the head and shoulders must lie lower than the breech, which being close to the side or foot of the bed, ought to be raised higher than either, because when the pelvis is in this situation, the hand and arm are easily pushed up in a right line, along the back part of the uterus, even to its fundus. Sometimes, however, when the feet of the child are towards the belly of the mother, they are more easily felt and managed when she lies on her side. At other times, placing the woman on her knees and elbows on a low couch, according to Daventer's method, will succeed better, by diminishing in part the strong resistance from the pressure and weight of the uterus and child, by which the feet will sometimes be easier found and delivered : but then it is safer for the child, and easier to the operator and mother, to turn her to her back before you deliver the body and head.

*Of the management of women in a NATURAL LABOUR.*

In a woman come to full time, labour commonly begins and proceeds in the following manner.

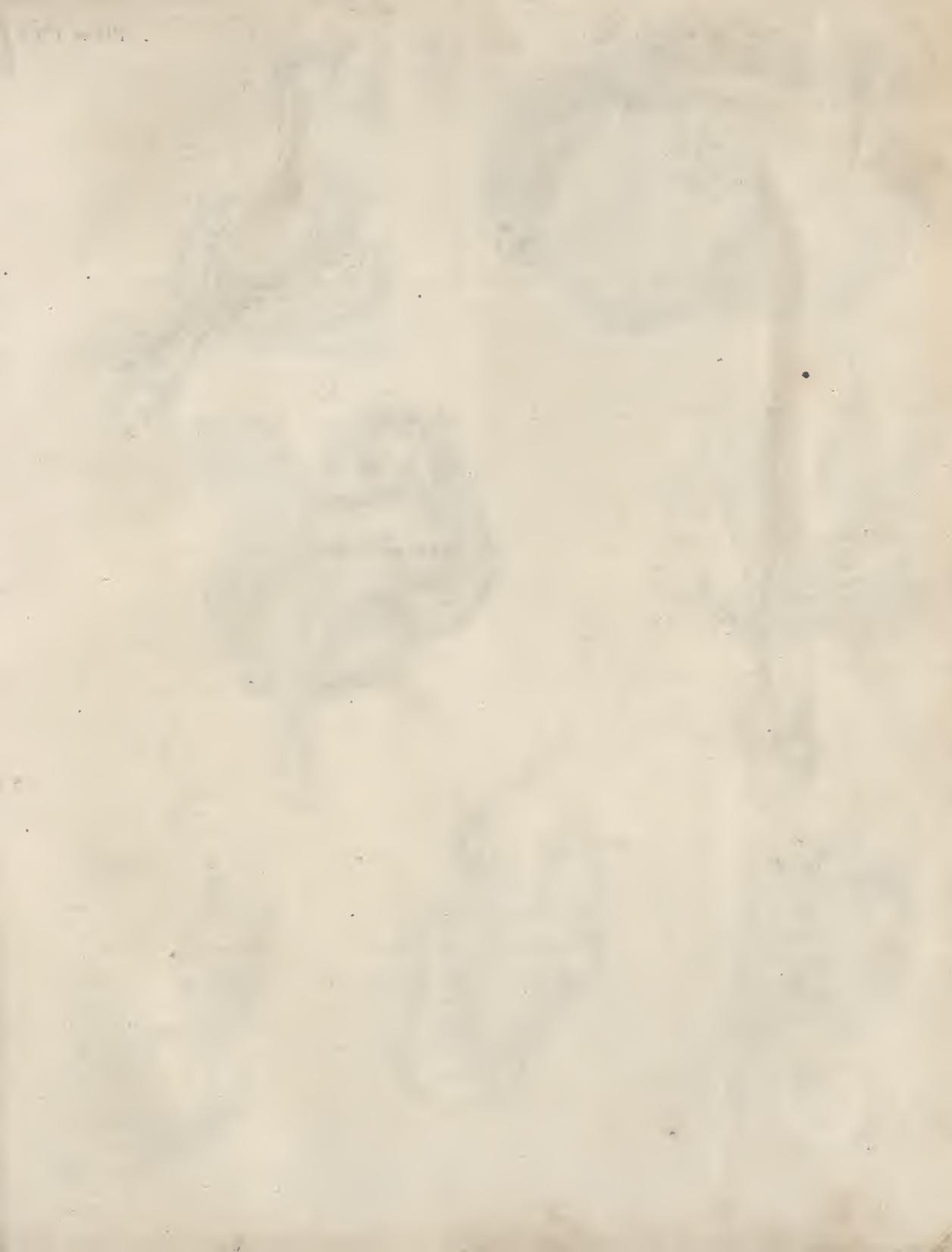
The os uteri is felt soft, and a little opened ; the circumference being sometimes thick, but chiefly thin : from this aperture is discharged a thick mucus, which lubricates the parts, and prepares them for stretching. This discharge usually begins some days before, and is accounted the forerunner of real labour : at the same time, the woman is seized at intervals with slight pains that gradually stretch the os uteri, fitting it for a larger dilatation ; and when labour actually begins, the pains become more frequent, strong, and lasting.

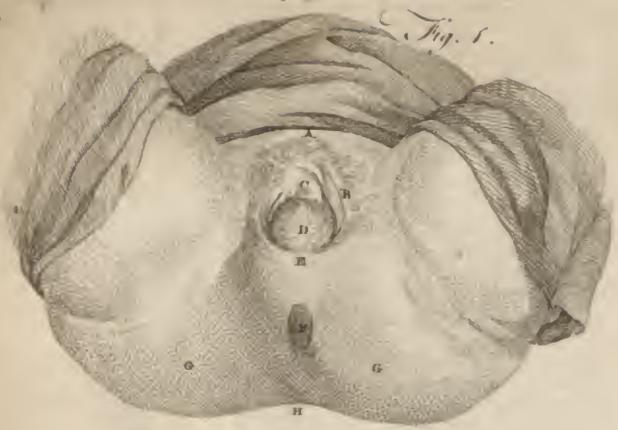
At every pain, the uterus is strongly compressed by the same effort which expels the contents of the rectum at stool, namely the inflation of the lungs, and the contraction of the abdominal muscles.

If the child be surrounded with a large quantity of waters, (see Plate CXI. fig. 4. and 6.) the uterus cannot come in contact with the body of it, but at every pain the membranes are pushed down by the fluid they contain, and the mouth of the womb being sufficiently opened by this gradual and repeated distension, they are forced into the middle of the vagina ; then the uterus contracts and comes in contact with the body of the child, and, if it be small, the head is propelled with the waters. Here the membranes usually break ; but, if that is not the case, they are pushed along towards the os externum, which they also gradually open, and appear on the outside, in the form of a large round bag. Mean while, the head advances, and the os externum being by this time fully dilated, is also protruded ; when, if the membranes, instead of bursting in the middle of the protuberance, are tore all round at the os externum, the child's head is covered with some part of them, which goes under the name of the caul, or king's hood. If the placenta is, at the same time, separated from the uterus, and the membranes remain unbroken, the secundines, waters, and child, are delivered together ; but, if the placenta adheres, they must of course give way : and should they be tore all around from the placenta, the greatest part of the body as well as the head of the child will be enveloped by them, from which it must be immediately disengaged, that the air may have a free passage into the lungs.

When the head is large, so that it does not descend immediately into the pelvis, the membranes are forced down by themselves ; and being stretched thinner and thinner, give way ; when all the waters which are farther advanced than the head, run out ; then the uterus coming in contact with the body of the child, the head is squeezed down into the mouth of the womb, which it plugs up so as to detain the rest of the waters. See Plate CXI. fig. 6.

Sometimes, when the quantity of waters is very small, and the uterus embraces the body of the child, the head, covered with the membranes, is forced downwards, and gradually opens the os internum ; but, at its arrival in the middle of the pelvis and vagina, part of the waters will be pushed down before it, sometimes in a large, and sometimes in a small proportion, towards the back part of the pelvis. At other times, when the waters are in small quantity, no part of them are to be distinguished farther than the head, which descending lower and lower, the attenuated membranes are split upon it ; while, at the same time, it fills up the mouth of the womb and up-  
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*A. Bell Sculp.*

per part of the vagina, in such a manner as hinders the few remaining waters from being discharged at once; though in every pain, a small quantity distils on each side of the head, for lubricating the parts, so as that the child may slip along the more easily.

The uterus contracts, the pains become quicker and stronger, the crown of the head is pushed down to the lower part of the pelvis, against one of the ischia, at its lower extremity; the forehead, being at the upper part of the opposite ischium, is forced into the hollow of the under part of the sacrum, while the vertex and hindhead is pressed below the os pubis, (see Plate, CXI. fig. 7.) from whence it rises in a quarter turn; gradually opening the os externum: the frænum labiorum, or fourchette, perinæum, fundament, and the parts that intervene betwixt that and the extremity of the sacrum, are all stretched outwards in form of a large tumour. The perinæum, which is commonly but one inch from the os externum to the anus, is now stretched to three, the anus to two, and the parts between that and the coccyx are stretched from two inches to about three or more. The broad sacrosciatic ligaments reaching from each side of the lower part of the sacrum, to the under part of each ischium, are also outwardly extended, and the coccyx is forced backward; while the crown of the head, where the lambdoidal crosses the end of the sagittal future, continues to be pushed along, and dilates the os externum more and more. See

Plate CXII. fig. 1. which is intended principally to shew in what manner the perinæum and external parts are stretched by the head of the fœtus, in a first pregnancy, towards the end of labour.

- A, The abdomen.
- B, The labia pudendi.
- C, The clitoris and its præputium.
- D, The hairy scalp of the fœtus swelled at the vertex, in a laborious case, and protruded to the os externum.
- EF, The perinæum and anus pushed out by the head of the fœtus in form of a large tumour.
- GG, The parts that cover the tuberosities of the ossa ischium.
- H, The part that covers the os coccygis.

When the head is so far advanced, that the back part of the neck is come below the under part of the os pubis, the forehead forces the coccyx, fundament, and perinæum, backwards and downwards; then the hindhead rises about two or three inches from under the pubes, making a half round turn in its ascent, by which the forehead is equally raised from the parts upon which it pressed, and the perinæum escapes without being split or torn: at the same time, the shoulders advance into the sides of the pelvis at its brim, where it is widest, and, with the body, are forced along and delivered: mean while, by the contraction of the uterus, the placenta and chorion are loosed from the inner surface to which they adhered, and forced through the vagina, out at the os externum.

When the head rests at first above the brim of the pelvis, and is not far advanced, the fontanelle may be plainly felt with the finger, commonly towards the side of the pelvis: this is the place where the coronal crosses the sagittal future, and the bones are a little separated

from each other, yielding a softness to the touch, by which may be distinguished four sutures, or rather one crossing another. These may be plainly perceived, even before the membranes are broke; yet the examination must not be made during a pain, when the membranes are stretched down and filled with waters; but only when the pain begins to remit, and the membranes to be relaxed; otherwise they may be broke too soon, before the os internum be sufficiently dilated, and the head properly advanced.

When the vertex is come lower down, the sagittal future only is to be felt; because, as the hindhead descends in the pelvis, the fontanelle is turned more backwards, to the side, or towards the concavity of the sacrum: but, after it has arrived below the under part of the ossa pubis, the lambdoidal may be felt crossing the end of the sagittal future, the occiput making a more obtuse angle than that of the parietal bones, at the place where the three are joined together. But all these circumstances are more easily distinguished after the membranes are broke, or when the head is so compressed that the bones ride over one another, provided the hairy scalp be not excessively swelled. See Plate CXI. fig. 7.—See also

Plate CXII. fig. 2. which shews in what manner the head of the fœtus is helped along with the forceps, as artificial hands, when it is necessary for the safety of either mother or child.

AABC, The vertebræ of the loins, os sacrum, and coccyx.

D, The os pubis of the left side.

E, The remaining part of the bladder.

FF, The intellinum rectum.

GGG, The uterus.

H, The mons veneris.

I, The clitoris, with the left nymphæ.

H, The corpus cavernosum clitoridis.

V, The meatus urinaris.

K, The left labium pudendi.

L, The anus.

N, The perinæum.

QP, The left hip and thigh.

R, The skin and muscular parts of the loins.

#### *How and when to break the MEMBRANES.*

If the child be surrounded with a large quantity of waters, the uterus cannot come in contact with the body so as to press down the head, until the membranes are pushed a considerable way before it into the vagina; nor even then, until they are broke, and the fluid diminished in such a manner as will allow the womb to contract, and, with the assistance of the pains, force along the child. When the membranes therefore are strong or unadvanced, and continue so long unbroke that the delivery is retarded, provided the os internum be sufficiently dilated, they ought to be broke without further delay; especially if the woman hath been much fatigued or exhausted with labour, or is seized with a violent flooding: in which case, the rupture of the membranes hastens delivery, and the hæmorrhage is diminished by the contraction of the uterus, which

which lessens the mouths of the vessels that are also compressed by the body of the child.

The common method of breaking the membranes is by thrusting the finger against them when they are protruded with the waters during the pain, or by pinching them with the finger and thumb; but if they are detained too high to be managed in either of these methods, the hand may be introduced into the vagina, if the os externum is so lax as to admit it easily; and if this cannot be done without giving much pain, the fore and middle fingers being pushed into the vagina with the other hand, let a probe or pair of pointed scissars be directed along and between them, and thrust through the membranes, when they are pushed with the waters below the head. This operation must be cautiously performed, lest the head should be wounded in the attempt; and as for the membranes, let the opening be never so small, the waters are discharged with force sufficient to tear them asunder.

If the vertex, instead of resting at the side of the brim of the pelvis, or at the os pubis, is forced further down to the os internum, and the waters happen to be in small quantity, the head is pushed forwards, and gradually opens the mouth of the womb without any sensible interposition of the waters: then it advances by degrees into the vagina, and the membranes being split or tore, little or nothing is discharged until the body of the child be delivered: and in this case, the hair of the head being plainly felt, will be a sufficient indication that the membranes are broke. If no hair is to be felt, but a smooth body presents itself to the touch; and the woman has undergone many strong pains, even after the mouth of the womb hath been largely dilated, and the head forced into the middle of the pelvis; you may conclude, that delivery is retarded by the rigidity of the membranes; that there is but a small quantity of waters; and that, if the containing sac were broke, the head would come along without further hesitation.

Sometimes, no waters can be felt while the head is no farther advanced than the upper part of the pelvis, because it plugs up the passage and keeps them from descending; but, as it advances downwards, the uterus contracts, and they are forced down in a small quantity towards the back part: from thence, as the head descends, or even though it should stick in that situation, they are pushed farther down, and the membranes may be easily broke; but the task is more difficult when no waters come down, and the membranes are contiguous to the head. In this case, they must be scratched a little during every pain, with the nail of a finger, which, though short and smooth, will, by degrees, wear them thinner and thinner, until they split upon the head by the force of labour. Yet this expedient ought never to be used until you are certain that delivery is retarded by their rigidity; for, if that be not the hindrance, the difficulty must proceed from the weakness of the woman, a large head, or narrow pelvis: in which case, the delivery is a work of time, and will be obstructed by the premature discharge of the waters, which by gradually passing by the head, ought to keep the parts moist and slippery, in order to facilitate the birth: for when the membranes are not broke until the head is forced into the middle of the pelvis, the largest

part of it being then past the upper part of the sacrum is commonly squeezed along, opens the os externum, and is delivered before all the waters are discharged from the uterus; so that what remains, by moistening and lubricating the parts, help the shoulders and body to pass with more ease. When the membranes are too soon broke, the under part of the uterus contracts sometimes so strongly before the shoulders, that it makes the resistance still greater.

In most natural labours, the space betwixt the fore and back fontanelles, viz. the vertex, presents to the os internum, and the forehead is turned to the side of the pelvis; because the basin at the brim is widest from side to side; and frequently, before the head is pushed in and fast wedged among the bones, the child (after a pain) is felt to move and turn it to that side or situation in which it is least pressed and hurt, if it was not presenting in that position before: but this position of the head may alter, viz. in those where it is as wide, or wider, from the back part to the fore part of the brim, than from side to side, the forehead may be turned backwards or forwards. But this form of the pelvis seldom happens.

This posture is always observed in a narrow pelvis, when the upper part of the sacrum jets forward to the pubes; but, as the child is forced lower down, the forehead turns into the hollow at the inferior part of the sacrum, because the vertex and occiput find less resistance at the lower part of the ossa pubis than at the ischium, to which it was before turned; the pelvis being at the pubes, as formerly described, no more than two inches in depth, whereas at the ischium it amounts to four. If, therefore, the forehead sticks in its former situation, without turning into the hollow, it may be assisted by introducing some fingers, or the whole hand, into the vagina, during a pain, and moving it in the right position.

When the head of the fœtus presents, and is forced along in any of those positions, the labour is accounted natural; and little else is to be done, but to encourage the woman to bear down with all her strength in every pain, and to rest quietly during each interval: if the parts are rigid, dry, or inflamed, they ought to be lubricated with pomatum, hog's lard, butter, or *ung. altheæ*: the two first are most proper for the external parts; and the two last (as being harder and not so easily melted) ought to be put up into the vagina, to lubricate that and the os internum.

The mouth of the womb and os externum, for the most part, open with greater difficulty in the first than in the succeeding labours, more especially in women turned of thirty. In these cases, the os externum must be gradually dilated in every pain, by introducing the fingers in form of a cone, and turning them round, so as to stretch the parts by gentle degrees; and the whole hand being admitted into the vagina, it will be sometimes found necessary to insinuate the fingers with the flat of the hand between the head and os internum: for, when this precaution is not taken in time, the os uteri is frequently pushed before the head (especially that part of it next the pubes) even through the os externum; or if the head passes the mouth of the womb, it will protrude the parts at the os externum, and will endanger a laceration in the perinæum.

pernæum. This dilatation, however, ought to be cautiously performed, and never attempted except when it is absolutely necessary; even then it must be effected slowly, and in time of a pain, when the woman is least sensible of the dilating force.

When the labour happens to be lingering, though every thing be in a right posture, if the assistants are clamorous, and the woman herself too anxious and impatient to wait the requisite time without complaining, the labour will be actually retarded by her uneasiness, which we must endeavour to surmount by arguments and gentle persuasion; but if she is not to be satisfied, and strongly impressed with an opinion that certain medicines might be administered to hasten delivery, it will be convenient to prescribe some innocent medicine, that she may take between whiles, to beguile the time and please her imagination: but, if she is actually weak and exhausted, it will be necessary to order something that will quicken the circulating fluids, such as preparations of amber, castor, myrrh, volatile spirits, *the pulv. myrrh. composit.* of the *London*, or *pulv. ad partum* of the *Edinburgh Pharmacopœia*, with every thing in point of diet and drink that nourishes and strengthens the body. If the patient is of a plethoric habit, with a quick strong pulse, the contrary method is to be used, such as venæsection, antiphlogistic medicines, and plentiful draughts of weak diluting fluids.

*How to behave when the birth is obstructed by the navel-string or shoulders of the child, or a narrow pelvis.*

ALTHOUGH the head is pushed down into the pelvis, and the vertex employed in opening the os externum, the forehead being lodged in the concavity formed by the coccyx and lower part of the sacrum; yet frequently after the labour-pain is abated, the head again is withdrawn by the navel-string happening to be twisted round the neck; or when the shoulders, instead of advancing, are retarded at the brim of the pelvis, one resting over the ossa pubis, while the other is fixed at the sacrum; or when (the waters having been long evacuated) the under-part of the uterus contracts round the neck and before the shoulders, keeping up the body of the child.

When the head is therefore drawn back by any of these obstacles, and the delivery hath been retarded during several pains, one or two fingers being introduced into the rectum before the pain goes off, ought to press upon the forehead of the child at the root of the nose, great care being taken to avoid the eyes: this pressure detains the head till the return of another pain, which will squeeze it farther down, while the fingers pushing slowly and gradually, turn the forehead half round outwards and half round upwards: By this assistance, and the help of strong pains, the child will be forced along, although the neck be entangled in the navel-string; for, as the child advances, the uterus contracts, and consequently the placenta is moved lower: the funis umbilicalis will also stretch a little, without obstructing the circulation.

The head being thus kept down, the shoulders too are pressed in every succeeding pain until they are forced into the pelvis, when the whole comes along without further difficulty. And this expedient will, moreover, an-

swer the purpose, when the under-part of the uterus or os internum is contracted round the neck of the child, and before the shoulders; also, when the head is very low, pressing a finger on each side of the coccyx externally will frequently assist in the same manner; also in lingering cases, when the woman is weak, the head large, or the pelvis narrow, you may assist the delivery by gently stretching both the os externum and internum with your fingers, in time of the pains, which will increase the same, as well as dilate; but this is only to be done when absolutely necessary, and with caution, and at intervals, for fear of inflaming or lacerating the parts.

Over and above these obstacles, the head may be actually delivered and the body retained by the contraction of the os externum round the neck, even after the face appears externally. In this case it was generally alledged that the neck was close embraced by the os internum; but this seldom happens when the head is delivered, because then the os internum is kept dilated on the back-part and sides by the breast and arms of the fœtus, unless it be forced low down with or before the head.

When the head is delivered and the rest of the body retained from the largeness or wrong presenting of the shoulders, or by the navel string's being twisted round the body or neck of the child, the head must be grasped on each side, the thumbs being applied to the occiput, the fore and middle fingers extended along each side of the neck, while the third and fourth of each hand support each side of the upper jaw: thus embraced, the head must be pulled straight forwards; and if it will not move easily along, the force must be increased, and the directions varied from side to side, or rather from shoulder to shoulder, not by sudden jerks, but with a slow, firm, and equal motion. If the body cannot be moved in this manner, though you have exerted as much force as possible without running the risk of over-straining the neck, you must endeavour to slip the turns of the navel-string over the head: but should this be found impracticable, you ought not to trifle in tying the string at two places, and cutting betwixt the ligatures, as some people have advised: such an operation would engross too much time; besides, the child is in no danger of suffocating from the stricture of the funis, because it seldom or never breaths before the breast is delivered.

The better method is, immediately to slide along one or two fingers, either above or below, to one of the arm-pits; by which you try to bring along the body, while, with the other hand, you pull the neck at the same time: if it still continues unmoved, shift hands, and let the other arm-pit sustain the force; but, if this fail, cut the navel-string, and tie it afterwards. If the shoulders lie so high that the fingers cannot reach far enough to cut or take sufficient hold, let the flat of the hand be run along the back of the child: or should the os externum be strongly contracted round the neck, push up your hand along the breast, and pull as before: and should this method fail, you must have recourse to the blunt hook introduced and fixed in the arm pit; but this expedient must be used with caution, lest the child should be injured, or the parts lacerated.

The child being born, the funis umbilicalis must be divided, and the placenta delivered, according to the directions that will occur in the sequel.

*How to manage the CHILD after DELIVERY.*

THE child being delivered, ought to be kept warm beneath the bed-cloaths, or immediately covered with a warmed flanel or linen clot: if it cries and breathes, the umbilical cord may be tied and cut, and the child delivered to the nurse without delay; but, if the air does not immediately rush into the lungs, and the circulation continues between it and the placenta, the operation of tying and cutting must be delayed, and every thing tried to stimulate, and sometimes to give pain. If the circulation is languid, respiration begins with difficulty, and proceeds with long intervals; and if it be entirely stopped in the funis; the child, if alive, is not easily recovered; sometimes, a great many minutes are elapsed before it begins to breathe. Whatever augments the circulating force, promotes respiration; and as this increases, the circulation grows stronger, so that they mutually assist each other. In order to promote the one and the other, the child is kept warm, moved, shaken, whipt; the head, temples, and breast rubbed with spirits, garlic, onion, or mustard applied to the mouth and nose; and the child has been sometimes recovered by blowing into the mouth with a silver canula, so as to expand the lungs.

When the placenta is itself delivered, immediately or soon after the child, by the continuance of the labour-pains, or hath been extracted by the operator, that the uterus may contract, so as to restrain too great a flooding; in this case, if the child has not yet breathed, and a pulsation is felt in the vessels, some people (with good reason) order the placenta, and as much as possible of the navel-string, to be thrown into a basin of warm wine or water, in order to promote the circulation between them and the child; others advise us to lay the placenta on the child's belly, covered with a warm cloth; and a third set order it to be thrown upon hot ashes: but, of these, the warm water seems the most innocent and effectual expedient. Nevertheless, if the placenta is still retained in the uterus, and no dangerous flooding ensues, it cannot be in a place of more equal warmth, while the operator endeavours, by the methods above described, to bring the child to life.

In lingering labours, when the head of the child hath been long lodged in the pelvis, so that the bones ride over one another, and the shape is preternaturally lengthened, the brain is frequently so much compressed, that violent convulsions ensue before or soon after the delivery, to the danger and oft-times the destruction of the child. This disorder is frequently relieved and carried off, and the bad consequences of the long compression prevented, by cutting the navel-string before the ligature is made, or tying it so slighty as to allow two, three, or four large spoonfuls to be discharged.

If the child has been dead one or two days before delivery, the lips and genitals (especially the scrotum in boys) are of a livid hue; if it hath lain dead in the uterus two or three days longer, the skin may be easily stripped from every part of the body, and the navel-string

appears of the same colour with the lips and genital: in ten or fourteen days, the body is much more livid and mortified, and the hairy scalp may be separated with ease; and indeed, any part of the child which hath been strongly pressed into the pelvis, and retained in that situation for any length of time, will adopt the same mortified appearance.

*How to tie the FUNIS UMBILICALIS.*

DIFFERENT practitioners have used different methods of performing this operation: some proposing to tie and separate the funis before the placenta is delivered; to apply one ligature close to the belly of the child, with a view to prevent a rupture of the navel; and making another two inches above the former, to divide the rope between the two tyings: by the second ligature, they mean to prevent a dangerous hæmorrhage from the woman, provided the placenta adheres to the uterus. But all these precautions are founded upon mistaken notions, and the following seems to be that which is easiest and best: If the placenta is not immediately delivered by the pains, and no flooding obliges you to hasten the extraction, the woman may be allowed to rest a little, and the child to recover; if it does not breathe, or the respiration is weak, let the methods above prescribed be put in practice, with a view to stimulate the circulation; but if the child is lively, and cries with vigour, the funis may be immediately tied in this manner: having provided a ligature or two, composed of sundry threads waxed together, so as to equal the diameter of a pack-thread, being seven inches in length, and knotted at each end, tie the navel-string about two fingers breadth from the belly of the child, by making at first one turn, if the funis be small, and securing it with two knots; but if the cord be thick, make two more turns, and another double knot; then cut the funis with a pair of sharp scissars one finger's breadth from the ligature towards the placenta; and in cutting run the scissars as near as possible to the root of the blades, else the funis will be apt to slip from the edge, and you will be obliged to make several snips before you can effect a separation: at the same time, guard the points of the scissars with your other hand. The child being washed, a linen rag is wrapped round the tied funis; which being doubled up along the belly, a square compress is laid over it, and kept firm or moderately tight with what the nurses call a belly-band, or roller round the body.

This portion of the funis soon shrinks, turns first livid, then black, and about the fifth day falls off close to the belly; and let the navel string be tied in any part, or at any distance whatsoever from the belly, it will always drop off at the same place: so that ruptures in the navel seldom or never depend upon the tying of the funis, but may happen when the compress and belly band are not kept sufficiently firm, and continued some time after the separation of the withered portion, especially in those children that cry much: the bandage ought always to be applied so slight as not to affect respiration.

The ligature upon the funis must always be drawn so tight as to shut up the mouths of the vessels: therefore, if they continue to pour out their contents, another ligature must be applied below the former; for if this precaution

caution be neglected, the child will soon bleed to death: yet, if the navel-string is cut or tore asunder at two or three hand-breadths from the belly, and exposed to the cold without any ligature, the arteries will contract themselves, so as that little or no blood shall be lost; nay, sometimes, if the funis hath been tied and cut at the distance of three finger-breadths from the child's belly, so as that it hath been kept from bleeding for an hour or two, although the ligature be then untied, and the navel-string and belly chafed, and soaked in warm water, no more blood will be discharged.

*Of delivering the PLACENTA.*

THE funis being separated, and the child committed to the nurse, the next care is to deliver the placenta and membranes, if they are not already forced down by the labour-pains. We have already observed, that if there is no danger from a flooding, the woman may be allowed to rest a little, in order to recover from the fatigue she has undergone; and that the uterus may, in contracting, have time to squeeze and separate the placenta from its inner surface: during which pause also, about one, two or three tea-cups full of blood is discharged through the funis, from the vessels of the placenta, which is thus diminished in bulk, so that the womb may be the more contracted; and this is the reason for applying one ligature only upon the cord. In order to deliver the placenta, take hold of the navel-string with the left hand, turning it round the fore and middle fingers, or wrapping it in a cloth, that it may not slip from your grasp; then pull gently from side to side, and desire the woman to assist your endeavour, by straining as if she were at stool, blowing forcibly into her hand, or provoking herself to reach by thrusting her finger into her throat. If by these methods the placenta cannot be brought away, introduce your hand slowly into the vagina, and feel for the edge of the cake; which when you have found, pull it gradually along; as it comes out at the os externum, take hold of it with both hands and deliver it, bringing away, at the same time, all the membranes, which, if they adhere, must be pulled along with leisure and caution.

When the funis takes its origin towards the edge of the placenta, which is frequently the case, the cake comes easier off by pulling, than when the navel-string is inserted in the middle, unless it be uncommonly retained by its adhesion to the womb, or by the strong contraction of the os internum. If the funis is attached to the middle of the placenta, and that part presents to the os internum or externum, the whole mass will be too bulky to come along in that position: in this case you must introduce two fingers within the os externum, and bring it down with its edge foremost.

When the placenta is separated by the contraction of the uterus, in consequence of its weight and bulk, it is pushed down before the membranes, and both are brought away inverted.

When part of the placenta hath passed the os internum, and the rest of it cannot be brought along by easy pulling, because the os uteri is close contracted round the middle of it, or part of it still adheres to the womb, slide the flat

of your hand below the placenta through the os internum; and having dilated the uterus, slip down your hand to the edge of the cake, and bring it along: but, if it adheres to the uterus, push up your hand again, and having separated it cautiously, deliver it as before.

If instead of finding the edge or middle of the placenta presenting to the os externum or internum, you feel the mouth of the womb closely contracted, you must take hold of the navel-string as above directed, and slide your other hand along the funis into the vagina; then slowly push your fingers and thumb, joined in form of a cone, through the os uteri, along the same cord, to the place of its insertion in the placenta: here let your hand rest, and feel with your fingers to what part of the uterus the cake adheres: if it be loose at the lower edge, try to bring it along; but if it adheres, begin and separate it slowly, the back of your hand being turned to the uterus, and the fore-part of your fingers towards the placenta: and for this operation the nails ought to be cut short and smooth. In separating, press the ends of your fingers more against the placenta than the uterus; and if you cannot distinguish which is which, because both feel soft (though the uterus is firmer than the placenta, and this last more solid than coagulated blood;) in this case, slide down your fingers to its edge, and conduct them by the separated part, pressing it gently from the uterus, until the whole is disengaged. Sometimes, when part of it is separated, the rest will loosen and come along, if you pull gently at the detached portion; but, if this is not effected with ease, let the whole of it be separated in the most cautious manner: sometimes, also, by grasping the inside of the placenta with your hand, the whole will be loosened without further trouble. As the placenta comes along, slide down your hand and take hold of the lower edge, by which it must be extracted, because it is too bulky to be brought away altogether in a heap; and let it be delivered as whole as possible, keeping your thumb or fingers fixed upon the navel-string, by which means laceration is often prevented.

When the woman lies on her back, and the placenta adheres to the left side of the uterus, it will be most commodious to separate the cake with the right hand; whereas the left hand is most conveniently used when the placenta adheres to the right side of the womb; but when it is attached to the forepart, back, or fundus, either hand will answer the purpose.

That part of the uterus to which the placenta adheres, is kept still distended, while all the rest of it is contracted.

The nearer the adhesion is to the os internum, the easier is the placenta separated, and *vice versa*; because it is difficult to reach up to the fundus, on account of the contraction of the os internum, and lower part of the womb, which are not stretched again without great force after they have been contracted for any length of time.

When therefore the placenta adheres to the fundus, and all the lower part of the womb is strongly contracted, the hand must be forced up in form of a cone into the vagina, and then gradually dilate the os internum and inferior part of the uterus. If great force is required, exert it slowly, resting between whiles, that the hand may not

be cramped, nor the vagina in danger of being tore from the womb; for in this case, the vagina will lengthen considerably upwards.

While you are thus employed, let an assistant press with both hands on the woman's belly; or while you push with one hand, press with the other, in order to keep down the uterus, else it will rise high up, and roll about like a large ball, below the lax parietes of the abdomen, so as to hinder you from effecting the necessary dilatation.

When you have overcome this contraction, and introduced your hand into the fundus, separate and bring the placenta along, as above directed; and should the uterus be contracted in the middle like an hour-glass, a circumstance that sometimes, though rarely happens, the same method must be practised.

In every case, and especially when the placenta hath been delivered with difficulty, introduce your your hand after its extraction, in order to examine if any part of the uterus be pulled down and inverted; and if that be the case, push it up and reduce it without loss of time, then clear it of the coagulated blood, which otherwise may occasion violent after-pains.

For the most part, in ten, fifteen, or twenty minutes, more or less, the placenta will come away of itself; and though some portion of it, or of the membranes, be left in the uterus, provided no great flooding ensues, it is commonly discharged in a day or two, without any detriment to the woman: but at any rate, if possible, all the secundines ought to be extracted at once, and before you leave your patient, in order to avoid reflections.

### OF LABORIOUS LABOURS.

#### *How LABORIOUS LABOURS are occasioned.*

ALL those cases in which the head presents, and cannot be delivered in the natural way, are accounted more or less laborious, according to the different circumstances from which the difficulty arises: and these commonly are, first, Great weakness, proceeding from loss of appetite and bad digestion; frequent vomitings, diarrhoeas, or dysenteries, floodings, or any other disease that may exhaust the patient; as also the fatigue she may have undergone by unskilful treatment in the beginning of labour.

Secondly, From excessive grief and anxiety of mind, occasioned by the unseasonable news of sudden misfortune in time of labour; which often affect her so, as to carry off the pains, and endanger her sinking under the shock.

Thirdly, From the rigidity of the os uteri, vagina, and external parts, which commonly happens to women in the first birth, especially to those who are about the age of forty: though it may be also owing to large callosities, produced from laceration or ulceration of the parts; or to glands and schirrous tumours that block up the vagina.

Fourthly, When the under-part of the uterus is contracted before the shoulders, or the body entangled in the navel-string.

Fifthly, From the wrong presentation of the child's head; that is, when the forehead is towards the groin or middle of the os pubis; when the face presents with the

chin to the os pubis, ischium, or sacrum; when the crown of the head rests above the os pubis, and the forehead or face is pressed into the hollow of the sacrum; and lastly, when one of the ears presents.

Sixthly, From the extraordinary ossification of the child's head, by which the bones of the skull are hindered from yielding, as they are forced into the pelvis; and form a hydrocephalus or dropfy, distending the head to such a degree, that it cannot pass along until the water is discharged.

Seventhly, From a too small or distorted pelvis, which often occurs in very little women, or such as have been rickety in their childhood. See Plate CXII. fig. 6. 7.

In all these cases, except when the pelvis is too narrow and the head too large, provided the head lies at the upper-part of the brim, or (though pressed into the pelvis) can be easily pushed back into the uterus, the best method is, to turn the child and deliver by the feet; but, if the head is pressed into the middle or lower part of the pelvis, and the uterus strongly contracted round the child, delivery ought to be performed with the forceps; and in all the seven cases, if the woman is in danger, and if you can neither turn, nor deliver with the forceps, the head must be opened and delivered with crotchets. Laborious cases, from some of the above recited causes, happen much oftener than those we call preternatural; but, those which proceed from a narrow pelvis, or a large head, are of the worst consequence. These cases demand greater judgment in the operator than those in which the child's head does not present; because in these last we know, that the best and safest method is to deliver by the feet; whereas in laborious births, we must maturely consider the cause that retards the head from coming along, together with the necessary assistance required; we must determine when we ought to wait patiently for the efforts of nature, and when it is absolutely necessary to come to her aid. If we attempt to succour her too soon, and use much force in the operation, so that the child and mother, or one of the two, are lost, we will be apt to reproach ourselves for having acted prematurely; upon the supposition, that if we had waited a little longer, the pains might have, by degrees, delivered the child; or at least, forced the head so low, as that we might have extracted it with more safety, by the assistance of the forceps. On the other hand, when we leave it to nature, perhaps by the strong pressure upon the head and brain, the child is dead when delivered, and the woman so exhausted with tedious labour, that her life is in imminent danger: in this case, we blame ourselves for delaying our help so long, reflecting that had we delivered the patient sooner, without paying such scrupulous regard to the life of the child, the woman might have recovered without having run such a dangerous risk. Doubtless it is our duty to save both mother and child, if possible; but, if that is impracticable, to pay our chief regard to the parent; and in all dubious cases, to act cautiously and circumspectly, to the best of our judgment and skill.

If the head is advanced into the pelvis, and the uterus strongly contracted round the child, great force is required to push it back into the womb, because the effort must be sufficient



Fig. 1.



Fig. 2.



Fig. 6.

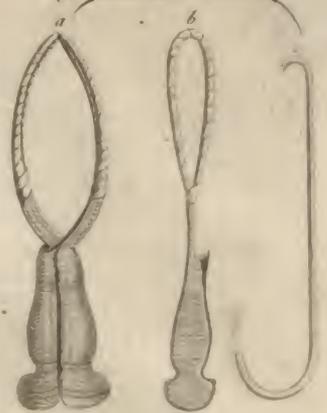


Fig. 3.



Fig. 7.

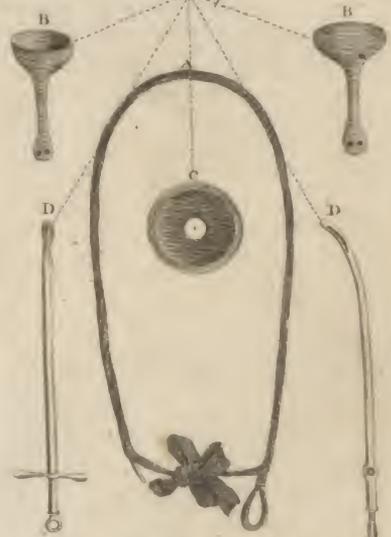


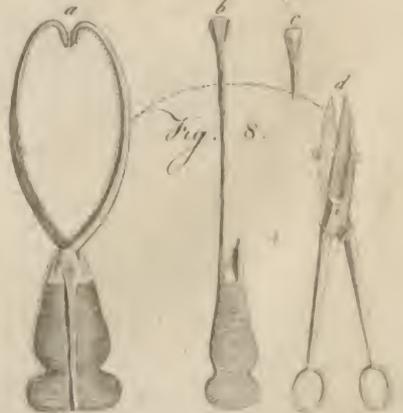
Fig. 4.



Fig. 5.



Fig. 8.



sufficient to stretch the uterus, so as to re-admit the head, together with your hand and arm; and even then the child will be turned with great difficulty.

Should you turn when the head is too large, you may bring down the body of the child, but the head will stick fast above, and cannot be extracted without the help of forceps or crotchets; (see explanation of Plate CXIII. fig. 5. below;) yet the case is still worse in a narrow pelvis, even though the head be of an ordinary size. When things are so situated, you should not attempt to turn, because in so doing you may give the woman a great deal of pain, and yourself much unnecessary fatigue: you ought therefore to try the forceps, and if they do not succeed, diminish the size of the head, and extract it, as shall be afterwards shewn.

Plate CXIII. fig. 5. represents, in a lateral view of the pelvis, the method of extracting, with the assistance of a curved crotchet, the head of the fœtus, when left in the uterus, after the body is delivered and separated from it; either by its being too large, or the pelvis too narrow.

ABC, The os sacrum and coccyx.

D, The os pelvis of the left side.

EE, The uterus.

F, The locking part of the crotchet.

g,h,i. The point of the crotchet on the inside of the cranium.

#### *Of the FILLETS and FORCEPS.*

WE have already observed, that the greatest number of difficult and lingering labours proceed from the head's sticking fast in the pelvis, which situation is occasioned by one of the seven causes recited above: when formerly this was the case, the child was generally lost, unless it could be turned and delivered by the feet; or if it could be extracted alive, either died soon after delivery, or recovered with great difficulty from the long and severe compression of the head, while the life of the mother was endangered from the same cause as above described: for, the pressure being reciprocal, the fibres and vessels of the soft parts contained in the pelvis are bruised by the child's head, and the circulation of the fluids obstructed; so that a violent inflammation, and sometimes a sudden mortification, ensues. If the child could not be turned, the method practised in these cases, was to open the head and extract with the crotchet; and this expedient produced a general clamour among the women, who observed, that when recourse was had to the assistance of a man-midwife, either the mother or child, or both, were lost. This censure, which could not fail of being a great discouragement to male practitioners, stimulated the ingenuity of several gentlemen of the profession, in order to contrive some gentler method of bringing along the head, so as to save the child, without any prejudice to the mother.

Their endeavours have not been without success: a more safe and certain expedient for this purpose hath been invented, and of late brought to greater perfection in this than in any other kingdom: so that if we are called in before the child is dead, or the parts of the woman in danger of a mortification, both the fœtus and mother may frequently be happily saved. This fortunate contrivance

is no other than the forceps, which was, as is alledged, first used here by the *Chamberlains*, by whom it was kept as a nostrum, and after their decease so imperfectly known, as to be seldom applied with success: so that different practitioners had recourse to different kinds of fillets or licks. Blunt hooks also of various make were invented in *England, France*, and other parts. The forceps, since the time of *Dr Chamberlain*, have undergone several alterations, particularly in the joining, handles, form, and composition.

The common way of using them formerly, was by introducing each blade at random, taking hold of the head any how, pulling it straight along, and delivering with downright force and violence; by which means, both os internum and externum were often tore, and the child's head much bruised. On account of these bad consequences, they had been altogether disused by many practitioners; some of whom endeavoured, in lieu of them, to introduce divers kinds of fillets over the child's head; but none of them can be so easily used, or have near so many advantages, as the forceps, when rightly applied and conducted.

For my own part, says *Dr Smellie*, finding in practice that, by the directions of *Chapman, Giffard, and Gregoire at Paris*, I frequently could not move the head along without confusing it, and tearing the parts of the woman; for they direct us to introduce the blades of the forceps where they will easiest pass and taking hold of the head in any part of it, to extract with more or less force, according to the resistance; I began to consider the whole in a mechanical view, and reduce the extraction of the child to the rules of moving bodies in different directions: in consequence of this plan, I more accurately surveyed the dimensions and form of the pelvis, together with the figure of the child's head, and the manner in which it passed along in natural labours: and from the knowledge of these things, I not only delivered with greater ease and safety than before, but also had the satisfaction to find in teaching, that I could convey a more distinct idea of the art in this mechanical light than in any other; and particularly, give more sure and solid directions for applying the forceps, even to the conviction of many old practitioners, when they reflected on the uncertainty attending the old method of application. From this knowledge, too, joined with experience, and hints which have occurred and been communicated to me, I have been led to alter the form and dimensions of the forceps, so as to avoid the inconveniencies that attended the use of the former kinds. See Plat. CXIII. fig. 6.

A, The straight forceps, in the exact proportion as to the width between the blades, and length from the points to the locking part; the first being two and the second six inches which, with three inches and a half, (the length of the handles), make in all eleven inches and a half.

B represents the posterior part of a single blade, in order to shew the width and length of the open part of the same, and the form and dimensions of the whole.

C, The blunt hook, which is used for three purposes:

1. To assist the extraction of the head, after the cranium is opened with the scissars, by introducing

the small end along the ear on the outside of the head to above the under jaw, where the point is to be fixed; the other extremity of the hook being held with one hand, whilst two fingers of the other are to be introduced into the foresaid opening, by which holds the head is to be gradually extracted.

2. The small end is useful in abortions, in any of the first four or five months, to hook down the secundines, when lying loose in the uterus, when they cannot be extracted by the fingers, or labour-pains, and when the patient is much weakened by floodings.

3. The large hook at the other end is useful to assist the extraction of the body, when the breech presents; but should be used with great caution, to avoid the dislocation or fracture of the thigh.

The lacks or fillets are of different kinds, of which the most simple is a noose made on the end of a fillet or limber garter: but this can only be applied, before the head is fast jammed in the pelvis, or when it can be pushed up and raised above the brim. The os externum and internum having been gradually dilated, this noose must be conveyed on the ends of the fingers, and slipped over the fore and hind head. There are also other kinds differently introduced upon various blunt instruments, too tedious either to describe or use: but the most useful of all these contrivances, is a fillet made in form of a sheath, mounted upon a piece of slender whale-bone, about two feet in length, which is easier applied than any other expedient of the same kind. See Plate CXIII. fig. 7.

A represents the whale-bone fillet, which may be sometimes useful in laborious cases, when the operator is not provided with the forceps, in sudden and unexpected exigencies.

BB, Two views of a pessary for the prolapsus uteri. After the uterus is reduced, the large end of the pessary is to be introduced into the vagina, and the os uteri retained in the concave part, where there are three holes to prevent the stagnation of any moisture. The small end without the os externum has two tapes drawn through the two holes, which are tied to four other tapes, that hang down from a belt that surrounds the woman's body, and by this means keep up the pessary. This pessary may be taken out by the patient when she goes to bed, and introduced again in the morning; but as this sometimes rubs the os externum, so as to make its use uneasy, the round kind, marked C<sub>1</sub> are of more general use. They are made of wood, ivory, or cork, (the last covered with cloth and dipt in wax.) The pessary is to be lubricated with pomatum, the edge forced through the passage into the vagina, and a finger introduced in the hole in the middle lays it across within the os externum. They ought to be larger or smaller, according to the wideness or narrowness of the passage, to prevent their being forced out by any extraordinary straining.

DD gives two views of a female catheter, to shew its degree of curvature and different parts.

When the head is high up in the pelvis, if the woman has been long in labour, and the waters discharged for a considerable time, the uterus being strongly contracted,

so as that the head and shoulders cannot be raised, or the child turned to be delivered by the feet, while the mother is enfeebled, and the pains so weak, that, unless assisted, she is in danger of her life; also, when the os internum, vagina, and labia pudendi, are inflamed, and tumefied; or when there is a violent discharge of blood from the uterus, provided the pelvis is not too narrow, nor the head too large, this fillet may be successfully used; in which case, if the os externum and internum are not already sufficiently open, they must be gradually dilated as much as possible, by the hand, which at the same time must be introduced and passed along the side of the head, in order to ascertain the position thereof. This being known, let the other hand introduce the double of the whale-bone and fillet over the face and chin, where you can have the best purchase, and where it will be least apt to slip and lose its hold. This application being effected, let the hand be brought down, and the whale-bone drawn from the sheath of the fillet, which (after the ends of it are tied together) must be pulled during every pain, pressing at the same time with the other hand, upon the opposite part of the head, and using more or less force according to the resistance.

The disadvantage attending all fillets, is the difficulty in introducing and fixing them: and though this last is easier applied than the others; yet when the vertex presents, the child's chin is so pressed to the breast, that it is often impracticable to insinuate the fillet between them; and if it is fixed upon the face or hind head, it frequently slips off, in pulling: but, granting it commodiously fixed, when the head is large, or the pelvis narrow; so that we are obliged to pull with great force, the fillet will gall, and even cut the soft parts to the very bone; and if the child comes out of a sudden, in consequence of violent pulling, the external parts of the woman are in great danger of sudden laceration: but, if the head is small, and comes along with a moderate force, the child may be delivered by this contrivance, without any bad consequence: though in this case, we find by experience, that unless the woman has some very dangerous symptom, the head will in time slide gradually down into the pelvis, even when it is too large to be extracted with the fillet or forceps, and the child be safely delivered by the labour-pains, although slow and lingering, and the mother seems weak and exhausted, provided she be supported with nourishing and strengthening cordials.

As the head in the 6th and 7th cases is forced along the pelvis, commonly in these laborious cases, the bones of the cranium are so compressed, that they ride over one another, so that the bulk of the whole is diminished, and the head, as it is pushed forward, is, from a round, altered into an oblong figure: when therefore it is advanced into the pelvis, where it sticks fast for a considerable time, and cannot be delivered by the labour-pains, the forceps may be introduced with great ease and safety, like a pair of artificial hands, by which the head is very little (if at all) marked, and the woman very seldom tore. But if the head is detained above the brim of the pelvis, or a small portion of it only farther advanced, and it appears, that the one being too narrow, or the other too large, the woman cannot be delivered by the strongest labour-pains;

in that case, the child cannot be saved either by turning and bringing it by the feet, or delivered by the application of fillet or forceps; but the operator must unavoidably use the disagreeable method of extracting with the crotchet. Nevertheless, in all these cases, the forceps ought first to be tried; and sometimes they will succeed beyond expectation, provided the birth is retarded by the weakness of the woman, and the second, third, fourth, or fifth obstructions: but they cannot be depended upon even when the vertex presents, with the forehead to the side or back part of the pelvis, and (though the woman has had strong pains for many hours after the membranes are broke) the head is not forced down into the pelvis, or at least, but an inconsiderable part of it, resembling the small end of a sugar-loaf. For, from these circumstances, you may conclude, that the largest part of it is still above the brim, and that either the head is too large, or the pelvis too narrow. Even in these cases, indeed, the last fillet or a long pair of forceps may take such firm hold, that, with great force and the strong purchase, the head will be delivered: but such violence is commonly fatal to the woman, by causing such an inflammation, and perhaps laceration of the parts, as is attended with mortification.

When the head is high, the forceps may be locked in the middle of the pelvis; but in that case, great care must be taken in feeling with the fingers all round, that no part of the vagina be included in the locking. Sometimes, when the head rests, or is pressed too much on the forepart or side of the pelvis, either at the brim or lower down, by introducing one blade, it may be moved farther down, provided the labour-pains are strong, and the operation assisted by the fingers of the other hand applied to the opposite side of the head; but if the fingers cannot reach high enough, the best method is to turn or move the blade towards the ear of the child, and introduce the other along the opposite side.

#### *General rules for using the FORCEPS.*

THE farther the head is advanced in the pelvis, the easier it is delivered with the forceps; because then, if in the 6th or 7th case, it is changed from a round to an oblong figure, by being forced along by the labour-pains; on the contrary, when the head remains high up, resting upon the brim of the pelvis, the forceps are used with greater difficulty and uncertainty.

The os externum must be gradually opened by introducing the fingers one after another, in form of a cone, after they have been lubricated with pomatum, moving and turning them in a semicircular motion, as they are pushed up. If the head is so low down that the hand cannot be introduced high up in this form, let the parts be dilated by the fingers turned in the direction of the coccyx, the back of the hand being upwards, next to the child's head: the external parts being sufficiently opened to admit all the fingers, let the back of the hand be turned to the perinæum, while the fingers and thumb being flattened, will slide along betwixt the head and the os sacrum. If the right hand be used, let it be turned a little to the left side of the pelvis, because the broad ligament and membrane that fill up the space between the

sacrum and ischia, will yield and allow more room for the fingers to advance; for the same reason, when the left hand is introduced, it must be turned a little to the right side. Having gained your point so far, continue to push up, until your fingers pass the os internum; at the same time, with the palm of your hand, raise or scoop up the head; by which means, you will be more at liberty to reach higher, dilate the internal parts, and distinguish the situation and size of the head, together with the dimensions of the pelvis: from which investigation, you will be able to judge, whether the child ought to be turned and brought by the feet, or delivered with the forceps; or, if the labour-pains are strong, and the head presents tolerably fair, without being jammed in the pelvis, you will resolve to wait some time, in hope of seeing the child delivered by the labour-pains, especially when the woman is in no immediate danger, and the chief obstacle is the rigidity of the parts.

The position of the head is distinguished by feeling for one of the ears, the fore or smooth part of which is towards the face of the child; if it cannot be ascertained by this mark, the hand and fingers must be pushed farther up, to feel for the face or back part of the neck; but, if the head cannot be traced, the observation must be taken from the fontanelle, or that part of the cranium where the lambdoidal crosses the end of the sagittal suture. When the ears of the child are towards the sides of the pelvis, or diagonal, the forehead being either to the sacrum or pubes, the patient must lie on her back, with her breech a little over the bed. If one ear is to the sacrum, and the other to the pubes, she must be laid on one side, with her breech over the bed, as before, her knees being pulled up to her belly, and a pillow placed between them; except when the upper part of the sacrum jets too much forward; in which case, she must lie upon her back, as above described.

The blades of the forceps ought always, if possible, to be introduced along the ears; by which means, they approach nearer to each other, gain a firmer hold, and hurt the head less than in any other direction: frequently, indeed, not the least mark of their application is to be perceived; whereas, if the blades are applied along the forehead and occiput, they are at a greater distance from each other, require more room, frequently at their points press in the bones of the skull, and endanger a laceration in the os externum of the woman. See Plate CXII. fig. 2.

The woman being laid in a right position for the application of the forceps, the blades ought to be privately conveyed between the feather-bed and the cloaths, at a small distance from one another, or on each side of the patient: that this conveyance may be the more easily effected, the legs of the instrument ought to be kept in the operator's side-pockets. Thus provided, when he sits down to deliver, let him spread the sheet that hangs over the bed, upon his lap, and under that cover, take out and dispose the blades on each side of the patient; by which means, he will often be able to deliver with the forceps, without their being perceived by the woman herself, or any other of the assistants. Some people pin a sheet to each shoulder, and throw the other end over the bed,

bed, that they may be the more effectually concealed from the view of those who are present: but this method is apt to confine and embarrass the operator. At any rate, as women are commonly frightened at the very name of an instrument, it is advisable to conceal them as much as possible, until the character of the operator is fully established.

*The different ways of using the FORCEPS.*

*When the Head is down to the Os Externum.*

WHEN the head presents fair, with the forehead to the sacrum, the occiput to the pubes, and the ears to the sides of the pelvis, or a little diagonal; in this case, the head is commonly pretty well advanced in the basin, and the operator seldom miscarries in the use of the forceps. Things being thus situated, let the patient be laid on her back, her head and shoulders being somewhat raised, and the breech advanced a little over the side or foot of the bed; while the assistants sitting on each side support her legs, at the same time keeping her knees duly separated and raised up to the belly, and her lower parts always covered with the bed cloaths, that she may not be apt to catch cold. In order to avoid this inconvenience, if the bed is at a great distance from the fire, the weather cold and the woman of a delicate constitution, a chafing-dish with charcoal, or a vessel with warm water, should be placed near, or under the bed. These precautions being taken, let the operator place himself upon a low chair, and having lubricated with pomatum the blades of the forceps, and also his right hand and fingers, slide first the hand gently into the vagina, pushing it along in a flattened form, between that and the child's head, until the fingers have passed the os internum; then, with his other hand, let him take one of the blades of the forceps from the place where it was deposited, and introduce it betwixt his right hand and the head; if the point or extremity of it should stick at the ear, let it be slipped backward a little, and then guided forwards with a slow and delicate motion: when it shall have passed the os uteri, let it be advanced still farther up, until the rest at which the blades lock into each other be close to the lower part of the head, or at least within an inch thereof.

Having in this manner introduced one blade, let him withdraw his right hand, and insinuate his left in the same direction, along the other side of the head, until his fingers shall have passed the os internum; then taking out the other blade from the place of concealment, with the hand that is disengaged, let it be applied to the other side of the child's head, by the same means employed in introducing the first; then the left hand must be withdrawn, and the head being embraced between the blades, let them be locked in each other. Having thus secured them, he must take a firm hold with both hands, and, when the pain comes on, begin to pull the head along from side to side, continuing this operation during every pain until the vertex appears through the os externum, and the neck of the child can be felt with the finger below the os pubis; at which time, the forehead pushes out the perinæum like a large tumour: then let him stand up, and raising the handles of the forceps, pull the head upwards

also, that the forehead being turned half round upwards, the perinæum and lower parts of the os externum may not be tore.

In stretching the os externum or internum, we ought to imitate nature: for in practice we find, that when they are opened slowly, and at intervals, by the membranes with the waters, or the child's head, the parts are seldom inflamed or lacerated: but in all natural labours, when these parts are suddenly opened, and the child delivered by strong and violent pains, without much intermission, this misfortune sometimes happens, and the woman is afterwards in great pain and danger.

We ought therefore, when obliged to dilate those parts, to proceed in that slow, deliberate manner; and though upon the first trial, they feel so rigid, that one would imagine they could never yield or extend; yet, by stretching with the hand, and resting by intervals, we can frequently overcome the greatest resistance. We must also, in such cases, be very cautious, pulling slowly, with intermissions, in order to prevent the same laceration: for which purpose too, we ought to lubricate the perinæum with pomatum, during those short intervals, and keep the palm of one hand close pressed to it and the neighbouring parts, while with the other we pull at the extremity of the handles of the forceps; by which means, we preserve the parts, and know how much we may venture to pull at a time. When the head is almost delivered, the parts, thus stretched, must be slipped over the forehead and face of the child, while the operator pulls upwards with the other hand, turning the handles of the forceps to the abdomen of the woman.

This method of pulling upwards, raises the child's head from the perinæum, and the half-round turn to the abdomen of the mother brings out the forehead and face from below; for, when that part of the hind-head which is joined to the neck, rests at the under-part of the os pubis, the head turns upon it, as upon an axis. In preternatural cases also, the body being delivered, must in the same manner be raised up over the belly of the mother, and at the same time the perinæum slip over the face and forehead of the child.

In the introduction of the forceps, let each blade be pushed up in an imaginary line from the os externum, to the middle space betwixt the navel and *scrobiculus cordis* of the woman; or, in other words, the handles of the forceps are to be held as far back as the perinæum will allow. The introduction of the other hand to the opposite side, will, by pressing the child's head against the first blade, detain it in its proper place till the other can be applied; or, if this pressure should not seem sufficient, it may be supported by the operator's knee.

When the head is come low down, and cannot be brought farther, because one of the shoulders rests above the os pubis, and the other upon the upper-part of the sacrum, let the head be strongly grasped with the forceps, and pushed up as far as possible, moving from blade to blade as you push up, that the shoulders may be the more easily moved to the sides of the pelvis, by turning the face or forehead a little towards one of them; then, the forehead must be brought back again into the hollow of the sacrum, and another effort made to deliver: but,  
should

should the difficulty remain, let the head be pushed up again, and turned to the other side; because it is uncertain which of the shoulders rests on the os pubis, or sacrum. Suppose, for example, the right shoulder of the child sticks above the os pubis, the forehead being in the hollow of the sacrum; in this case, if the forehead be turned to the right-hand side of the woman, the shoulder will not move; whereas, if it be turned to the left, and the head at the same time pushed a little upwards, so as to raise and disengage the parts that were fixed, the right shoulder being towards the right hand side, and the other to the left side of the brim of the pelvis, when the forehead is turned back again into the hollow of the sacrum, the obstacle will be removed, and the head be more easily delivered. This being performed, let the forceps be unlocked, and the blades disposed cautiously under the claviis so as not to be discovered; then proceed to the delivery of the child, which, when the navel-string is cut and tied, may be committed to the nurse. The next care is to wipe the blades of the forceps, singly, under the cloaths, slide them warily into your pockets, and deliver the placenta.

*When the forehead is to the Os Pubis.*

WHEN the forehead, instead of being towards the sacrum, is turned forwards to the os pubis, the woman must be laid in the same position as in the former case; because here also, the ears of the child are towards the sides of the pelvis, or a little diagonally situated, provided the forehead is towards one of the groins. The blades of the forceps being introduced along the ears, or as near them as possible, according to the foregoing directions, the head must be pushed up a little, and the forehead turned to one side of the pelvis; thus let it be brought along, until the hindhead arrives at the lower part of the ischium: then the forehead must be turned backward, into the hollow of the sacrum, and even a quarter or more to the contrary side, in order to prevent the shoulders from hitching on the upper part of the os pubis, or sacrum, so that they may be still towards the sides of the pelvis; then let the quarter-turn be reversed, and the forehead being replaced in the hollow of the sacrum, the head may be extracted as above. In performing these different turns, let the head be pushed up or pulled down occasionally, as it meets with least resistance. In this case, when the head is small, it will come along as it presents; but if large, the chin will be so much pressed against the breast, that it cannot be brought up with the half-round turn, and the woman will be tore if it comes along. See Plate CXII, where

FIG. 3. shows the head of the fœtus, by strong labour-pains, squeezed into a length form, with a tumour on the vertex, from a long compression of the head in the pelvis.

K, The tumour on the vertex.

L, The forceps.

M, The vesica urinaria much distended with a large quantity of urine from the long pressure of the head against the urethra.

N, The under part of the uterus.

OO, The os uteri.

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*When it presents fair at the brim of the Pelvis.*

WHEN the forehead and face of the child are turned to the side of the pelvis, (in which case it is higher than in the first situation), it will be difficult, if the woman lies on her back, to introduce the forceps so as to grasp the head with a blade over each ear; because the head is often pressed so hard against the bones, in this position, that there is no room to insinuate the fingers between the ear and the os pubis. So as to introduce the blades safely, on the inside of the os internum, or push one of them up between the fingers and the child's head. When things are so situated, the best posture for the woman is that of lying on one side, as formerly directed, because the bones will yield a little, and the forceps (of consequence) may be the more easily introduced.

Suppose her lying on her left side, and the forehead of the child turned to the same side of the pelvis; let the fingers of the operator's right hand be introduced along the ear, between the head and the os pubis, until they pass the os internum: if the head is so immovably fixed in the pelvis, that there is no passage between them, let his left hand be pushed up between the sacrum and the child's head, which being raised as high as possible, above the brim of the pelvis, he will have room sufficient for his fingers and forceps; then let him slide up one of the blades, with the right hand, remembering to press the handle backwards to the perineum, that the point may humour the turn of the sacrum and child's head: this being effected, let him withdraw his left hand, with which he may hold the handle of the blade, already introduced, while he insinuates the fingers of his right hand at the os pubis, as before directed, and pushes up the other blade, slowly and gently, that he may run no risk of hurting the os internum or bladder; and here also keep the handle of it as far backwards as the perineum will allow: when the point has passed the os internum, let him slide it up farther, and join the legs by locking them together, keeping them still in a line with the middle space betwixt the navel and scrobiculus cordis. Then let him pull along the head, moving it from side to side, or from one ear of the child to the other; when it is sufficiently advanced, let him move the forehead into the hollow of the sacrum, and a quarter-turn farther, then bring it back into the same cavity; but, if the head will not easily come along, let the woman be turned on her back after the forceps have been fixed, and the handles firmly tied with a garter or fillet; let the hindhead be pulled half round outwards, from below the os pubis, and the instrument and child managed as before.

In all those cases that require the forceps, if the head cannot be raised above the brim of the pelvis, or the fingers introduced within the os internum, to guide the points of the forceps along the ears, especially at the ossa pubis, ischia, or sacrum; let the fingers and hand be pushed up as far as they will go, along the open space betwixt the sacrum and ischium; then one of the blades may be introduced, moved to, and fixed over the ear, the situation of which is already known: the other hand may be introduced, and the other blade conducted in the same manner, on the opposite side of the pelvis; but, before

they are locked together, care must be taken that they are exactly opposite to each other, and both sufficiently introduced. In this case, if the operator finds the upper part of the sacrum jerking, in so much that the point of the forceps cannot pass it, let him try with his hand to turn the forehead a little backwards, so that one ear will be towards the groin, and the other towards the side of that prominence; consequently, there will be more room for the blades to pass along the ears: but if the forehead should remain immoveable, or though moved return to its former place, let one blade be introduced behind one ear, and its fellow before the other, in which case the introduction is sometimes more easily performed when the woman lies on her back, than when she is laid on one side. See Plate CXII. fig. 2.

*When the FACE presents.*

WHEN the face presents, resting on the upper part of the pelvis, the head ought to be pushed up to the fundus uteri, the child turned and brought by the feet, because the hind head is turned back on the shoulders, and, unless very small, cannot be pulled along with the forceps; but should it advance pretty fast in the pelvis, it will be sometimes delivered alive, without any resistance. But, if it descends slowly, or, after it is low down, sticks for a considerable time, the long pressure on the brain frequently destroys the child, if not relieved in time, by turning or extracting with the forceps.

When the head is detained very high up, and no signs of its descending appear, and the operator having stretched the parts with a view to turn, discovers that the pelvis is narrow, and the head large, he must not proceed with turning, because after this hath been performed, perhaps with great difficulty, the head cannot be delivered without the assistance of the crotchet. No doubt it would be a great advantage in all cases where the face or forehead presents, if we could raise the head so as to alter the bad position, and move it so, with our hand, as to bring the crown of the head to present: and indeed this should always be tried, and more especially, when the pelvis is too narrow, or the head too large; and when we are dubious of saving the child by turning: but frequently this is impossible to be done, when the waters are evacuated, the uterus strongly contracted on the child, and the upper part of the head so slippery as to elude our hold; in so much that, even when the pressure is not great, we seldom succeed, unless the head is small, and then we can save the child by turning. If you succeed, and the woman is strong, go on as in natural labour; but, if this fails, then it will be more advisable to wait with patience for the descent of the head, so as that it may be delivered with the forceps; and consequently the child may be saved; but, if it still remains in its high situation, and the woman is weak and exhausted, the forceps may be tried; and, should they fail, recourse must be had to the crotchet; because the mother's life is always to be more regarded than the safety of the child.

When the face of the child is come down, and sticks at the os externum, the greatest part of the head is then squeezed down into the pelvis, and if not speedily delivered, the child is frequently lost by the violent com-

pression of the brain: besides, when it is so low down, it seldom can be returned, on account of the great contraction of the uterus. In this case, when the chin is turned towards the os pubis, at the lower part of that bone, the woman must be laid on her back, the forceps introduced, as formerly directed in the first case, and when the chin is brought out from under the os pubis, the head must be pulled half round upwards; by which means the fore and hind head will be raised from the perinæum, and the under part of the os externum prevented from being tore.

If the chin points to either side of the pelvis, the woman must be laid on her side, the blades of the forceps introduced along the ears, one at the os pubis, and the other at the sacrum; and the chin, when brought lower down, turned to the pubis, and delivered: for the pelvis being only two inches in depth at this place, the chin is easily brought from under it, and then the head is at liberty to be turned half round upwards; because the chin being disengaged from this bone, can be pulled up over it externally; by which means, two inches of room, at least, will be gained, for the more easy delivery of the fore and hind head, which are now pressed against the perinæum. When the chin is towards the sacrum, the hind head pressed back betwixt the shoulders, so that the face is kept from rising up below the os pubis, the head must be pushed up with the hand, to the upper part of the pelvis, and the forceps introduced and fixed on the ears; the hindhead must be turned to one side of the pelvis, while the chin is moved to the other side, and, if possible, to the lower part of the ischium; then the hind head must be brought into the hollow of the sacrum, with the chin below the os pubis, and delivered as above directed. If this cannot be done, let the operator try, with the forceps, to pull down the hind-head below the os pubis, and at the same time, with the fingers of the other hand, push the face and forehead backwards and upwards into the hollow of the sacrum.

For when the chin points to the back part of the pelvis, the forehead is squeezed against the os pubis, while the hind-head is pressed upon the back, betwixt the shoulders; so that the head cannot be delivered unless, the occiput can be brought out from below the os pubis, as formerly described. See Plate CXII. fig. 4, and 5.

FIG. 4. shews, in the lateral view the face of the child presenting and forced down into the lower part of the pelvis, the chin being below the pubes, and the vertex in the concavity of the os sacrum:

The water being likewise all discharged, the uterus appears closely joined to the body of the child.

FIG. 5. shews, in a lateral view, the head of the child in the same position as in the former figure.

AB, The vertebrae of the loins, os sacrum, and coccyx.

C, The os pubis of the left side.

D, The inferior part of the rectum.

E, The perinæum.

F, The left labium pudendi.

GGG, The uterus.

The sum of all that has been said on this head, may be comprehended in the following general maxims.

Young practitioners are often at a loss to know and judge

judge by the touch in the vagina, when the head is far enough down in the basin for using the forceps. If we were to take our observations from what we feel of the head at the os pubis, we should be frequently deceived; because in that place the pelvis is only two inches in depth, and the head will seem lower down than it really is: but if, in examining backwards, we find little or no part of it towards the sacrum, we may be certain that all the head is above the brim: if we find it down as far as the middle of the sacrum, one third of it is advanced; if as far down as the lower part, one half; and in this case, the largest part is equal with the brim. When it is in this situation, we may be almost certain of succeeding with the forceps; and when the head is so low as to protrude the external parts, they never fail. But these things will differ according to different circumstances, that may occasion a tedious delivery.

Let the operator acquire an accurate knowledge of the figure, shape, and dimensions of the pelvis, together with the shape, size, and position of the child's head.

Let the breech of the woman be always brought forwards, a little over the bed, and her thighs pulled up to her belly, whether she lies on her side or back, to give room to apply, and to move the forceps up or down, or from side to side.

Let the parts be opened and the fingers pass the os internum; in order to which, if it cannot be otherwise accomplished, let the head be raised two or three inches, that the fingers may have more room; if the head can be raised above the brim, your hand is not confined by the bones; for, as we have already observed, the pelvis is wider from side to side, at the brim, than at the lower part; if the fingers are not past the os uteri, it is in danger of being included betwixt the forceps and the child's head.

The forceps, if possible, should pass along the ears, because, in that case, they seldom or never hurt or mark the head.

They ought to be pushed up in an imaginary line, towards the middle space between the navel and scrobiculus cordis, otherwise the ends will run against the sacrum.

The forehead ought always to be turned into the hollow of the sacrum, when it is not already in that situation. When the face presents, the chin must be turned to below the os pubis, and the hind-head into the hollow of the sacrum.

When the shoulders rest at the pubes, where they are detained, the head must be turned a large quarter to the opposite side, so as that they may lie towards the sides of the pelvis.

The head must always be brought out with an half round turn, over the outside of the os pubis, for the preservation of the perinæum, which must at the same time be supported with the flat of the other hand, and slide gently backwards over the head.

When the head is so low as to protrude the parts, in form of a large tumour, and the vertex hath begun to dilate the os externum, but, instead of advancing, is long detained in that situation, from any of the forementioned causes of laborious cases, and the operator cannot exactly distinguish the position of the head, let him introduce a finger between the os pubis and the head, and he will

frequently find the back part of the neck, or one ear, at the forepart, or towards the side of the pelvis: when the situation is known, he needs not stretch the os externum, and raise the head, as formerly directed; but he may introduce the forceps, and they being properly joined, and their handles tied, pull gently during every pain; or if the pains are gone, at the interval of four or five minutes, that the parts may be slowly dilated, as they are in the natural labour: but, when the situation cannot be known, the head ought to be raised. The same method may also be taken when the face presents, and is low in the pelvis, except when the chin is toward the back part: and in this case, the head ought to be raised likewise.

Almost all these directions are to be followed, except when the head is small, in which case it may be brought along by the force of pulling: but this only happens when the woman is reduced, and the labour-pains are not sufficient to deliver the child; for, the lower part of the uterus may be strongly contracted before the shoulders, and so close to the neck of the child, as to prevent its advancing, even when the head is so loose in the pelvis, that we can sometimes push our fingers all round it: and this is oftentime the occasion of preventing the head's being delivered when low in the pelvis. The difficulty, when high up, is from the restraint at the brim; and when it passes that, the head is seldom retained in the lower part, unless the patient is weak. In this case, we need not wait, because we are commonly certain of relieving the woman immediately with the forceps, by which you prevent the danger that may happen both to the mother and child, by the head's continuing to lodge there too long. This case should be a caution against breaking the membranes too soon, because the uterus may contract too forcibly and too long before the shoulders; when the head in this case is advanced one third or half way on the outside of the os externum, if the pains are strong, this last inconvenience is frequently remedied by introducing your two fingers into the rectum, as formerly directed: by these rules, delivery may (for the most part) be performed with ease and safety: nevertheless, the head is sometimes so squeezed and locked in the pelvis, and the hairy scalp so much swelled, that it is impracticable to raise up the head so as to come at the ears or os internum; or to distinguish the sutures of the skull, so as to know how the heads presents. In this case, the forceps must be introduced at random, and the uncertainty of the position generally removed by remembering, that in those cases, where the head is squeezed down with great difficulty, the ears are for the most part towards the os pubis and sacrum; and that the forehead seldom turns into the hollow of the sacrum, before the occiput is come down to the lower part of the ischium; and then rises gradually towards the under part of the os pubis, and the perinæum and anus are forced down before it, in form of a large tumour.

On such occasions, the woman being laid on her side, if one ear is to the sacrum and the other to the os pubis, the blades of the forceps are to be introduced; and if they meet with any resistance at the points, they must not be forcibly thrust up, lest they pass on the outside of the os uteri, and tear the vagina, which, together with the

womb, would be included in the instrument, and pulled along with the head: for this reason, if the blade does not easily pass, let it be withdrawn a little downwards, as before directed, and pushed up again, moving the point close to the head; if the ear obstructs its passage, let the point be brought a little outwards: and by these cautious essays, it will at length pass without further resistance, and ought to be advanced a considerable way, in order to certify the operator that he is not on the outside of the os internum.

When the forceps are fixed, and the operator uncertain which way the forehead lies, let him pull slowly, and move the head with a quarter turn, first to one side and then to the other, until he shall have found the direction in which it comes most easily along.

If at any time we find the forceps begin to slip, we must rest, and push them up again gently: but, if they are like to slide off at a side, untie the handles, and move them so as to take a firmer hold, fix as before, and deliver. If we are obliged to hold with both hands, the parts may be supported by the firm application of an assistant's hand; for, without such cautious management, they will run a great risk of being lacerated; a misfortune which rarely happens, when the perinæum is properly pressed back, and the head leisurely delivered. Sometimes, when the head is brought low down, you may take off the forceps, and help along with your fingers on each side of the coccyx, or in the rectum, as directed in the natural labour.

If the head is low down, the ears are commonly diagonal, or to the sides; and when the head is brought down one third, or one half, through the os externum, the operator can then certify himself, whether the forehead is turned to the coccyx or os pubis, by feeling with his finger for the back-part of the neck or ear, betwixt the os pubis and the head; and then move the head as above directed.

Let him try to alter with his hand every bad position of the head; and if it be detained high up in the pelvis, in consequence of the woman's weakness, the rigidity of the parts, the circumvolutions or shortness of the funis, or the contraction of the uterus over the shoulders of the child, the forceps will frequently succeed when the fœtus cannot be turned: but, if the head is large, or the pelvis narrow, the child is seldom saved either by turning or using the forceps, until the head shall be farther advanced. And here it will not be amiss to observe, that the blades of the forceps ought to be new covered with stripes of washed leather after they shall have been used, especially in delivering a woman suspected of having an infectious distemper.

#### *The signs of a Dead Child.*

WHEN the head presents, and cannot be delivered by the labour-pains; when all the common methods have been used without success, the woman being exhausted, and all her efforts vain; and when the child cannot be delivered without such force as will endanger the life of the mother, because the head is too large or the pelvis too narrow; it then becomes absolutely necessary to open the head, and extract with the hand, forceps, or crotchet.

Indeed this last method formerly was the common practice when the child could not be easily turned, and is still in use with those who do not know how to save the child by delivering with the forceps: for this reason, their chief care and study was to distinguish whether the fœtus was dead or alive; and as the signs were uncertain, the operation was often delayed until the woman was in the most imminent danger; or when it was performed sooner, the operator was frequently accused of rashness, on the supposition that the child might in time have been delivered alive by the labour-pains: perhaps he was sometimes conscious to himself of the justice of this imputation, although what he had done was with an upright intention.

The signs of a dead fœtus were, first, the child's ceasing to move and stir in the uterus. Secondly, The evacuation of meconium, though the breech is not pressed into the pelvis. Thirdly, No perceivable pulsation at the fontanelle and temporal arteries. Fourthly, A large swelling or tumour of the hairy scalp. Fifthly, An uncommon laxity of the bones of the cranium. Sixthly, The discharge of a fetid ichor from the vagina, the effluvia of which surrouned the woman and gave rise to the opinion that her breath conveyed a mortified smell. Seventhly, Want of motion in the tongue, when the face presents. Eighthly, No perceivable pulsation in the arteries of the funis umbilicalis, when it falls down below the head; nor at the wrist when the arm presents; and no motion of the fingers. Ninthly, The pale and livid countenance of the woman. Tenthly, A collapsing and flaccidity of the breast. Eleventhly, A coldness felt in the abdomen, and weight, from the child's falling like a heavy ball to the side on which she lies. Twelfthly, A separation of the hairy scalp on the slightest touch, and a distinct perception of the bare bones.

All or most of these signs are dubious and uncertain, except the last, which can only be observed after the fœtus hath been dead several days. One may also certainly pronounce the child's death, if no pulsation hath been felt in the navel string for the space of twenty or thirty minutes; but the same certainty is not to be acquired from the arm, unless the skin can be stripped off with ease.

#### *When the CROTCHEt is to be used.*

MIDWIFERY is now so much improved, that the necessity of destroying the child does not occur so often as formerly: indeed it never should be done, except when it is impossible to turn, or to deliver with the forceps; and this is seldom the case but when the pelvis is too narrow, or the head too large to pass, and therefore rests above the brim: for this reason, it is not so necessary for the operator to puzzle himself about dubious signs; because in these two cases, there is no room for hesitation: for if the woman cannot possibly be delivered in any other way, and is in imminent danger of her life, the best practice is undoubtedly to have recourse to that method which alone can be used for her preservation, namely, to diminish the bulk of the head.

In this case, instead of destroying, you are really saving a life; for, if the operation be delayed, both mother and child are lost.

*The method of using the Scissars, blunt Hook, and CROTCHET.*

WHEN the head presents, and such is the case that the child can neither be delivered by turning, nor extracted with the forceps, and it is absolutely necessary to deliver the woman to save her life, this operation must then be performed in the following manner.

The operator must be provided with a pair of curved crotchets, made according to the improvements upon those proposed by Mesnard, together with a pair of scissars about nine inches long, with rests near the middle of the blades, and the blunt hook.

*Of the Woman's Posture.*

THE patient ought to be laid on her back or side in the same position directed in the use of the forceps; the operator must be seated on a low chair, and the instruments concealed and disposed in the same manner, and for the same reason mentioned in treating of the forceps. The parts of the woman have already, in all likelihood, been sufficiently dilated by his endeavours to turn or deliver with the forceps; or if no efforts of that kind have been used, because by the touch he had learned that no such endeavours would succeed, as in the case of a large hydrocephalus, when the bones of the cranium are often separated at a great distance from each other; or upon perceiving that the pelvis was extremely narrow: If, upon these considerations, he hath made no trials in which the parts were opened, let him gradually dilate the os externum and internum, as formerly directed.

The head is commonly kept down pretty firm, by the strong contraction of the uterus round the child; but should it yield to one side, let it be kept steady by the hand of an assistant, pressing upon the belly of the woman; let him introduce his hand, and press two fingers against one of the futures of the cranium; then take out his scissars from the place in which they were deposited, and guiding them by the hand and fingers till they reach the hairy scalp, push them gradually into it, until their progress is stopped by the rests.

If the head slips aside, in such a manner, as that they cannot be pushed into the skull at the future, they will make their way through the solid bones, if they are moved in a semicircular turn, like the motion of boring, and this method continued till you find the point firmly fixed; for, if this is not observed, the points slide along the bones.

The scissars ought to be so sharp at the points, as to penetrate the integuments and bones when pushed with a moderate force; but not so keen as to cut the operator's fingers, or the vagina in introducing them.

The scissars being thus forced into the brain, as far as the rests at the middle of the blades, let them be kept firm in that situation; and the hand that was in the vagina being withdrawn, the operator must take hold of the handles with each hand, and pull them asunder, that the blades may dilate and make a large opening in the skull; then they must be shut, turned, and again pulled asunder, so as to make the incision crucial; by which means the opening will be enlarged, and sufficient room made for the introduction of the fingers: let them be as-

terwards closed, and introduced even beyond the rests; when they must again be opened, and turned half round from side to side, until the structure of the brain is so effectually destroyed, that it can be evacuated with ease. This operation being performed, let the scissars be shut and withdrawn; but, if this instrument will not answer the last purpose, the business may be done by introducing the crotchet within the opening of the skull. The brain being thus destroyed, and the instrument withdrawn, let him introduce his right hand into the vagina, and two fingers into the opening which hath been made, that if any sharp splinters of the bones remain, they may be broken off and taken out; lest they should injure the woman's vagina, or the operator's own fingers.

If the case be an hydrocephalus, let him fix his fingers on the inside and his thumb on the outside of the opening, and endeavour to pull along the skull in time of a pain; but, if labour is weak, he must desire the woman to assist his endeavours by forcing down; and thus the child is frequently delivered; because, the water being evacuated, the head collapses of course.

But when the pelvis is narrow, the head requires much greater force to be brought along; unless the labour-pains are strong enough to press it down and diminish it, by squeezing out the cerebrum: in this case, let the operator withdraw his fingers from the opening, and, sliding them along the head, pass the os uteri; then, with his left hand, taking one of the crotchets from the place of its concealment, introduce it along his right hand, with the point towards the child's head, and fix it above the chin in the mouth, back part of the neck, or above the ears, or in any place where it will take firm hold: having fixed the instrument, let him withdraw his right hand, and with it take hold on the end or handle of the crotchet; then introduce his left to seize the bones at the opening of the skull (as above directed) that the head may be kept steady, and pull along with both hands.

If the head is still detained by the uncommon narrowness of the pelvis, let him introduce his left hand along the opposite side, in order to guide the other crotchet; which being also applied and locked or joined with its fellow, in the manner of the forceps, he must pull with sufficient force, moving from side to side, and as it advances, turn the fore head into the hollow of the sacrum, and extract as with the forceps, humouring the shape of the head and pelvis during the operation, which ought to be performed slowly, with great judgment and caution; and from hence it appears absolutely necessary to know how the head presents, in order to judge how the crotchet must be fixed, and the head brought along to the best advantage.

If, when the head is delivered in this manner, the body cannot be extracted, on account of its being much swelled, of a monstrous size, or (which is most commonly the case) the narrowness of the pelvis; let him desist from pulling, lest the head should be separated from the body, and introducing one hand so as to reach with his fingers to the shoulder-blades or breast, conduct along it one of the crotchets, with the point towards the fœtus, and fix it with a firm application; then withdrawing his hand, employ it in pulling the crotchet, while the other

is exerted in the same manner upon the head and neck of the child: if the instrument begins to lose its hold, he must push it farther up, and fixing it again, repeat his efforts, applying it still higher and higher, until the body is extracted.

#### Of PRETERNATURAL LABOURS.

PRETERNATURAL labour happens, when, instead of the head, some other part of the body presents to the os uteri. Preternatural labours are more or less difficult according to the presentation of the child, and the contraction of the uterus round its body. The nearer the head and shoulders are the os internum or lower part of the uterus, the more difficult is the case; whereas, when the head is towards the fundus, and the feet or breech near the os internum, it is more easy to turn and deliver.

To begin with the easiest of these first, it may be proper to divide them into three classes. First, how to manage when the feet, breech, or lower parts present. Secondly, how to behave in violent floodings; and, when the child presents wrong before the membranes are broke, how to save the waters in the uterus, that the fœtus may be the more easily turned: and what method to follow even after the membranes are broke, when all the waters are not evacuated. Thirdly, how to deliver when the uterus is strongly contracted; the child presenting either with the fore or back parts; and lying in a circular form, or with the shoulders, breast, neck, face, ear, or vertex, and lying in a longish form, with the feet and breech towards the fundus of the womb, which is contracted like a long sheath, close to the body of the fœtus; and when the fore-parts of the child lie towards the side, fundus, fore or back part of the uterus.

*The first class of PRETERNATURAL LABOURS. When the feet, breech, or lower parts of the fœtus present, and the head, shoulders, and upper parts are towards the fundus.*

THESE, for the most part, are accounted the easiest, even although the uterus should be strongly contracted round the body of the child, and all the waters discharged.

If the knees or feet of the child present to the os internum, which is not yet sufficiently dilated to allow them and the body to come farther down; or, if the woman is weak, wore out with long labour, or endangered by a flooding; let the operator introduce his hand into the vagina, push up and stretch the os uteri, and bring along the feet; which being extracted, let him wrap a linen cloth round them, and pull until the breech appears on the outside of the os externum: if the face or fore-part of the fœtus is already towards the back of the uterus, let him persist in pulling in the same direction; but, if they are towards the os pubis, or to one side, they must be turned to the back-part of the uterus; and as the head does not move round equal with the body, he must make allowance for the difference in turning, by bringing the last one quarter farther than the place at which the head is to be placed; so that the face or forehead which was towards one of the groins will be forced to the side of the sacrum, where it joins with the ischium. This quar-

ter turn of the body must be again undone, without affecting the position of the head; a cloth may be wrapped round the breech, for the convenience of holding it more firmly; then, placing a thumb along each side of the spine, and with his fingers grasping the belly, let him pull along the body from side to side, with more or less force, according to the resistance: when the child is delivered as far as the shoulders, let him slide his hand flattened (suppose the right, if she lies on her back) between its breast and the perinæum, coccyx, and sacrum of the woman, and introduce the fore or middle finger (or both, if necessary) into the mouth of the fœtus; by which means, the chin will be pulled to the breast, and the forehead into the hollow of the sacrum. And this expedient will also raise upwards the hindhead, which rests at the os pubis.

When the forehead is come so low as to protrude the perinæum, if the woman lies on her back, let the operator stand up, and pull the body and head of the child upwards, bringing the forehead with an half-round turn from the under part of the os externum, which will thus be defended from laceration. The application of the fingers in the child's mouth will contribute to bring the head out in this manner, prevent the os externum from hitching on the chin, help along the head, and guard the neck from being overstrained; a misfortune which would infallibly happen, if the forehead should be detained at the upper part of the sacrum: nor is there any great force required to obviate this inconvenience, or the least danger of hurting the mouth, if the head is not large: for, if the head cannot be brought along with moderate force; and the operator is afraid of injuring or over-straining the lower jaw, let him push his fingers farther up, and press on each side of the nose, or on the inferior edges of the sockets of the eyes. If the legs are come out, and the breech pulled into the vagina, there is no occasion for pushing up to open, but only to pull along and manage as above directed; still remembering to raise the forehead slowly from the perinæum, which may be pressed back with the fingers of his other hand.

In the case of a narrow pelvis, or large head, which cannot be brought along without the risk of over-straining the neck, let him slide up his fingers and hand into the vagina, and bring down one of the child's arms, at the same time pulling the body to the contrary side, by which means the shoulder will be brought lower down: let him run his fingers along the arm, until they reach the elbow; which must be pulled downwards with an half round turn to the other side, below the breast. This must not be done with a jerk, but slowly and cautiously, in order to prevent the dislocation, bending, or breaking of the child's arm.

Let him again guide his fingers into the child's mouth, and try if the head will come along: if this will not succeed, let the body be pulled to the other side, so as to bring down the other shoulder; then slide up his left hand, and, extracting the other arm, endeavour to deliver the head. If one finger of his right hand be fixed in the child's mouth, let the body rest on that arm: let him place the left hand above the shoulders, and put a finger on each side of the neck: if the forehead is towards one side

side at the upper part of the pelvis, let him pull it lower down, and gradually turn it into the hollow of the sacrum; then stand up, and, in pulling, raise the body, so as to bring out the head in an half-round turn, as above directed.

When the forehead is hindered from coming down into the lower part of the sacrum by an uncommon shape of the head or pelvis, and we cannot extract it by bringing it out with an half-round turn at the os pubis, we must try to make this turn in the contrary direction; and instead of introducing our fingers into the child's mouth, let the breast of it rest on the palm of your left hand, (the woman being on her back,) and placing the right on its shoulders, with the fingers on each side of the neck, press it downwards to the perinæum. In consequence of this pressure, the face and chin being within the perinæum, will move more upwards, and the head come out with an half-round turn from below the os pubis: for the centre of motion is now where the fore-part of the neck presses at the perinæum; whereas, in the other method, the back part of the neck is against the lower part of the os pubis, on which the head turns.

If the forehead is not turned to one side, but sticks at the upper part of the sacrum, especially when the pelvis is narrow; let him endeavour, with his finger in the mouth, to turn it to one side of the jetting in of the sacrum, because the pelvis is wider at the sides of the brim, and bring it along as before.

If one of the child's arms, instead of being placed along the sides of the head, is turned in between the face and sacrum, or between the hindhead and os pubis, the same difficulty of extracting occurs as in a large head or narrow pelvis; and this position frequently ensues, when the fore-parts of the child's body are turned from the os pubis down to the sacrum: if they are turned to the left side of the woman, the left hand and arm are commonly brought in before the face, and *vice versa*; but, in these cases, the elbow is, for the most part, easily come at, because it is low down in the vagina, and then there is a necessity for bringing down one or both arms before the head can be delivered: from whence we may conclude, that those authors are sometimes in the wrong, who expressly forbid us to pull down the arms. Indeed, if the pelvis is not narrow, nor the head very large, and the arms lie along the sides of the head, there is seldom occasion to pull them down; because, the pelvis is widest at the sides, and the membranes and ligaments that fill up the space betwixt the sacrum and ischia yield to the pressure, and make room for the passage of the head: but when they are squeezed between the head and the sacrum, ischia, or ossa pubis, and the head sticks in the pelvis, they certainly ought to be brought down, or even when the head comes along with difficulty. Neither is the alleged contraction of the os internum round the neck of the child so frequent as hath been imagined; because, for the most part, the contraction embraces the head and not the neck: but, should the neck alone suffer, that inconvenience may be removed by introducing the hand into the vagina, and a finger or two into the child's mouth, or on each side of the nose: by which means also a sufficient dilatation will be preserved in the os externum,

which frequently contracts on the neck, as soon as the arms are brought out.

The diameter, from the face or forehead to the vertex, being greater than that from the forehead to the back part of the hindhead or neck, when the hindhead rests at the os pubis, and the forehead at the upper part of the sacrum, the head can seldom be brought down, until the operator, by introducing a finger into the mouth, moves the same to the side, brings the chin to the breast, and the forehead into the hollow of the sacrum; by which means, the hindhead is raised, and allowed to come along with greater ease: and in pulling, half the force only is applied to the neck, the other half being exerted upon the head, by the finger which is fixed in the mouth; so that the forehead is more easily brought out, by pulling upwards, with the half-round turn from the perinæum. When the operator, with his fingers in the child's mouth, cannot pull down the forehead into the hollow of the sacrum, let him push the fore-finger of his left hand betwixt the neck and os pubis, in order to raise the hindhead upwards; which being done, the forehead will come down with less difficulty, especially if he pushes up and pulls down at the same time, or alternately.

If it be discovered by the touch, that the breech presents, that the membranes are not yet broke, the woman in no danger, the os internum not yet sufficiently dilated, and the labour-pains strong; the midwife ought to wait until the membranes, with the waters, are pushed farther down, as in the natural labour: for, as they come down through the os uteri into the vagina, they stretch open the parts contained in the pelvis; and the bulk within the uterus being diminished, it contracts and comes in contact with the body of the child; so that the breech is pushed along by the mechanical force of the abdominal muscles operating upon the womb.

The same consequence will follow even although the membranes are broke; for the waters lubricate the parts as they flow off; and the breech, if not too large, or the pelvis narrow, is pushed down. In this case, when the nates present equal and fair to the os uteri, so it is also reasonable to conclude, that when the breech presents, it lies in the same manner, but that the fore-parts of the child are rather turned backwards to one side of the vertebræ of the loins: in this position, one hip will present, and the other rest on the os pubis; but, when forced along with pains, the last will be gradually moved more and more to the groin of that side, and from thence slip down at the side of the basin: the lower at the same time will be forced to the other, and the hollow betwixt the thighs will rest upon the jetting in of the os sacrum, and come down in that manner; the thighs on each side, and the back and round part of the breech passing in below the arch of the os pubis, which is the best position: but if the back of the child is tilted backwards, then it will be forced down in the contrary direction, and come along with more difficulty, *viz.* the thighs to the os pubis, and back to the sacrum; when it is come down to the middle or lower part of the pelvis, let the operator introduce the fore-finger of each hand, along the outside, to the groins, and, taking hold, pull gently along during a strong pain.

If the os externum is so contracted, that he cannot  
take

take sufficient hold, let it be opened slowly, so as to allow his hands to be pushed up with ease; when he has insinuated a finger or two in each groin, let him place his thumbs on the thighs, if they are towards the os pubis, so as to obtain a firm hold; then pull along from side to side, and, if the back of the child is to the os pubis, continue to assist in this manner, until the body and head are delivered: the legs being commonly stretched up along the belly and breast, when the child is extracted as far as the shoulders, they come out of themselves, or are easily brought down; but, if the belly of the child is turned to one side, or to the os pubis, in that case, when the breech is delivered, he ought to turn the belly down to the sacrum, and the back to the os pubis; and that the face may be also turned to the back of the mother, let him remember the quarter extraordinary, which must be again reversed, and then he may pull along and deliver.

If the body cannot be turned until the thighs and legs are brought down, either on account of the bulk, or because the hold on the breech is not sufficient, let him continue to pull along, until the hams appear on the outside of the os externum; then seize one of the knees with his finger and thumb, and extract that leg; and let the other be brought down in the same manner. If he attempts to pull out the legs, before the hams arrive at this place, the thighs are always in danger of being bent or broke. When the legs are delivered, let him wrap a cloth round the breech of the child, and as the body was pulled down almost as far as the breast, before the legs could be brought out, it must be pushed up again to the navel, or above it; because, without this precaution, the shoulders would be so much engaged in the pelvis, that it would be impracticable to make the motions formerly directed, so as to turn the face to the back of the mother: whereas, when the body is pushed up, those turns can be effected with greater ease, because the belly being in the pelvis, it yields easier to the form of the basin. When the face is turned properly down, let him proceed to deliver, as above directed.

If the breech is detained above the pelvis, either by its uncommon magnitude, or the narrowness of the basin; or if one of the nates is pushed in, while the other rests above the os pubis, sacrum, or to either side; if the woman is low and weak, the pains lingering and insufficient to force the child along; or if she is in danger from a violent flooding: in any of these cases, let him (during every pain) gradually open first the os externum, and then the os internum; with his fingers and hand. Having thus gained admission, let him push up the breech to the fore or back part, or to one side of the uterus, that his hand and arm may have room to slide along the fore-parts or belly of the child, so as to feel the thighs, that will direct him to the legs, which must be brought down with his fingers, while, at the same time, he pushes up the hams with his thumb, that in case the legs lie straight up, they may be extracted with more ease by the flexion of the knee, and run the less risk of being bent, broke, or overstrained: for, if they are folded downward, they are the more easily brought out.

If the breech be strongly pressed into the upper part of the pelvis, let him also push it upwards and to one side,

that his hand and arm may have free passage; for the higher the breech is raised out of his way, he will be at more freedom to extract the legs.

If both legs cannot be easily brought down, he may safely deliver with one, of which taking hold with a linen cloth wrapped round it, let him slide up his other hand into the vagina, and a finger or two into the outside of the groin which is bent: by these means, the hip will come down the easier, and the leg, which is already extracted, will not be over-strained by sustaining the whole force of pulling the body along.

If the legs lie towards the left side of the woman, who is laid on her back, the right hand must be introduced into the uterus; if they lie to her right side, the left hand will better answer the purpose; and if they are towards her back or belly, either hand may be indifferently used.

In all cases where the breech presents, the safest practice is always to push up and bring down the legs, provided the os uteri is sufficiently dilated, and the waters not wholly discharged. If the waters are evacuated, the uterus strongly contracted around the child, the breech low, so as that it cannot be returned, or so small as to come easily along, we ought then to deliver it accordingly; but, if so large as neither to be pushed up or brought along with the assistance of the fingers, let the operator introduce the curved handle of the blunt crotchet into one of the groins, his fingers into the other, and pull very cautiously, in order to prevent a fracture or dislocation of the thigh bone, which might otherwise happen from the use of this instrument, the blunt point of which must be sufficiently past the groin. A fillet may also be used for the same purpose.

In the foregoing cases the woman was supposed to be laid on her back, her legs supported, and breech to the bed-side; this being generally the best position for delivering the body and head: indeed, when the child is small, she may lie on her side, and the same methods be used in delivering, provided the operator still remembers that in this position the ilium and ischium of one side are down, and the others up. Besides, when the breech is pushed up, in order to bring down the legs, if they lie forewards towards the fore part of the uterus, and the belly is pendulous, he can reach them with the greatest ease when she lies on one side, or, if the resistance is very great, turn her to her knees and elbows; but, when the legs are delivered, if the child is large, or the pelvis narrow, she ought to be turned upon her back, because the body and head can be better and safer delivered by pulling up and down; and in that posture she is also kept more firm, and her thighs less in the operator's way, than when she lies upon her side. See Plate CXIII. fig. 1. and 2.

#### *The second class of PRETERNATURAL LABOURS.*

WHEN the membranes are broke, but the face, shoulder, or some other part of the child, being pushed into the pelvis, locks up the os internum, so as that a small quantity of the waters hath been discharged, the uterus is kept from contracting strongly round the child, which is therefore more easily turned than it possibly can be when they are all gone:

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When, before the membranes are broke, the child is felt through them, presenting wrong, and at the same time the pains push them down so as to dilate the os internum more or less:

When the woman, at any time in the four last months, is seized with a violent flooding that cannot be restrained, and unless speedily delivered must lose her life; if labour-pains cannot be brought on by stretching the parts, delivery must be forced; but, if she is in labour, and the membranes have been pushed down with the waters, they may be broke; by which means, the flooding is frequently diminished, and the child delivered by the labour-pains.

In these three different cases, if we can prevent the strong contraction of the uterus by keeping up the waters, we can also for the most part turn the child with great ease, even in the very worst positions.

In the first case, let the operator slowly introduce his hand into the vagina, and his fingers between that part of the child which is pushed down, and the os internum: if in so doing he perceives some of the waters coming along, he must run up his hand as quick as possible into the uterus, betwixt the inside of the membranes and the child's body: the lower part of his arm will then fill up the os externum like a plug, so that no more of the waters can pass; let him turn the child with its head and shoulders up to the fundus, the breech down to the lower part of the uterus, and the fore-parts towards the mother's back; let the hand be pushed no farther up than the middle of the child's body, because, if it is advanced as high as the fundus, it must be withdrawn lower, before the child can be turned; and by these means the waters will be discharged, and the uterus of consequence contract so as to render the turning more difficult.

In the second case, when the membranes are not broke, and we are certain that the child does not present fair; if the os internum is not sufficiently dilated, and the woman is in no danger, we may let the labour go on, until the parts are more stretched; lubricating and extending the os externum, by degrees, during every pain. Then introducing one hand into the vagina, we insinuate it in a flattened form, within the os internum, and push up between the membranes and the uterus, as far as the middle of the womb: having thus obtained admission, we break the membranes by grasping and squeezing them with our fingers, slide our hand within them, without moving the arm lower down, then turn and deliver as formerly directed; but if, in any of these cases, you find the head is large or the pelvis narrow, bring down the head into the natural position, and assist as directed in lingering or laborious cases.

If the woman (in the third case) is attacked with a violent flooding, occasioned by a separation of all or any part of the placenta from the uterus, during the last four months of pregnancy, and every method has in vain been tried to lessen and restrain the discharge, the operator ought to pronounce the case dangerous, and prudently declare to the relations of the patient, that unless she is speedily delivered, both she and the child must perish, observing at the same time, that by immediate delivery they may both be saved; let him also desire the assistance and advice of some person eminent in the profession, for

the satisfaction of her friends, and the support of his own reputation. Where there are no labour-pains, and the mouth of the womb is not dilated, it is sometimes very difficult to deliver, more especially if the os internum is not a little lax, but feels rigid.

If the os uteri is so much contracted, that the finger cannot be introduced, some authors have recommended a dilator, by which it may be gradually opened so as to admit a finger or two. Doubtless, some cases may happen, in which this may be necessary. If in stretching the os internum, labour-pains are brought on, let the operator slowly proceed and encourage them: when the mouth of the womb is opened, if the head presents and the pains are strong, by breaking the membranes the flooding will be diminished; but, if the floods to such a degree as to be in danger of her life, and the dilatation does not bring on labour, at least not enough for the occasion, she must be immediately delivered in the following manner: but in the first place let her friends be apprized of the danger, and the operator beware of promising to save either mother or child.

The operator having performed his duty in making the friends acquainted with the situation of the case, must gently open the os externum, by introducing his fingers gradually, turning them half round and pushing upward; then forming them, with the thumb, into the figure of a wedge or cone, continue to dilate slowly and by intervals, until his hand is admitted into the vagina: having thus far gained his point, let him insinuate, in the same slow cautious manner, first one, then two fingers, into the os internum, which may be dilated so as to admit the other two and the thumb in the same conical form, which will gradually make way for sliding the hand along between the outside of the membranes and inside of the uterus; then he must manage as directed in the second case: If, upon sliding up his hand upon the outside of the membranes, he feels the placenta adhering to that side of the womb, he must either withdraw that hand, and introduce the other on the opposite side, or break through the membranes at the lower edge of the placenta.

The greatest danger in this case frequently proceeds from the sudden emptying of the uterus and belly; for when labour comes on of itself, or is brought on in a regular manner, and the membranes are broke, the flooding is gradually diminished, and first the child, then the placenta, is delivered by the pains; so that the pressure or resistance is not all at once removed from the belly and uterus of the woman, which have time to contract by degrees; consequently, those fainting fits and convulsions are prevented which often proceed from a sudden removal of that compression under which the circulation was performed.

The younger the woman is with child, the greater is the difficulty in opening the os internum; and more so in the first child, especially if she is past the age of thirty-five.

We should never refuse to deliver in these dangerous cases, even although the patient seems expiring: for, immediately after delivery, the uterus contracts; the mouths of the vessels are shut up, so that the flooding ceases; and she may recover, if she lives five or six hours

after the operation, and can be supported by frequent draughts of broth; jelly, caudle, weak cordial, and anodyne medicines, which maintain the circulation, and gradually fill the empty vessels.

If, in time of flooding, she is seized with labour-pains, or if, by every now and then stretching with your fingers the os internum, you bring on labour, by which either the membranes or head of the child is pushed down; and opens the os internum, the membranes ought to be broke; so that some of the waters being discharged, the uterus may contract and squeeze down the fœtus. This may be done sooner in those women who have had children formerly. If, notwithstanding this expedient, the flooding still continues, and the child is not like to be soon delivered, it must be turned immediately; or, if the head is in the pelvis, delivered with the forceps: but, if neither of these two methods will succeed, on account of the narrowness of the pelvis, or the bigness of the head, this last must be opened and delivered with the crochets. In all these cases, let the parts be dilated slowly and by intervals, in order to prevent laceration. See Plate CXL. fig. 4. 5. 6.

#### *The third class of PRETERNATURAL LABOURS.*

WE have already observed, that the principal difficulties in turning children and bringing them by the feet, proceeded from the contraction of the uterus and bad position of the fœtus. If the child lies in a round form, whether the fore-parts are towards the os internum, or up to the fundus uteri, we can, for the most part, move it with the hand, so as to turn the head and shoulders to the upper part, and the breech and legs downwards; but if the child lies lengthways, the womb being contracted around it, like a long sheath, the task is more difficult; especially, if the head and shoulders of the child are down at the lowest part of the uterus, with the breech and feet turned up to the fundus.

The hand of the operator being introduced into the uterus, if he finds the breech below the head and shoulders, let him search for the legs, and bring them down: but if the breech be higher than the upper parts of the child, or equal with them, he must try to turn the head and shoulders to the fundus, and the breech downwards, by pushing up the first, and pulling down the last; then proceed with delivery as before directed. This is commonly executed with ease, provided some part of the waters still remain in the uterus; but, if the woman has been long in labour, and the waters discharged, the contraction of the womb is so strong, that the child cannot be turned without the exertion of great force frequently repeated. In this case, the easiest method both for the patient and operator, is to push up the hand gradually on that side to which the legs and thighs are turned; and even after he has reached them, if they are not very high up, let him advance his hand as far as the fundus uteri; he will thus remove the greatest obstacle, by enlarging the cavity of the womb, so as more easily to feel and bring down the legs: then he may push up and pull down, as we have prescribed above: but, if the head and shoulders still continue to hinder the breech and body from coming along, and the feet cannot be brought so low, as the outside of the

os externum, while they are yet in the vagina he may apply a noose upon one or both; for unless the child is so small that he can turn it round by grasping the body when the head and shoulders are pushed up, and he endeavours to bring down the other part, they will again return to the same place, and retard delivery: whereas, if he gains a firm hold of the feet, either without the os externum, or in the vagina, by means of the noose fixed upon the ankles, he can with the other hand push up the head and shoulder, and be able in that manner to bring down the breech. He must continue this method of pushing up and pulling down, until the head and shoulder are raised to the fundus uteri; for should he leave off too soon, and withdraw his hand, although the child is extracted as far as the breech, the head is sometimes so pressed down and engaged with the body in the passage, that it cannot be brought farther down without being tore along with the crochet; for the breech and part of the body may block up the passage in such a manner, as that the hand cannot be introduced to raise the head.

Those cases are commonly the easiest in which the fore-parts present, and the child lies in a round or oval form, across the uterus, or diagonally, when the head or breech is above and over the os pubis, with the legs, arms, and navel-string, or one or all of them, at the upper or lower part of the vagina, or on the outside of the os externum. Those are more difficult in which, though the child lies in the same round or contracted form, the back, shoulders, belly, or breast, are over the os internum; because if we cannot move the child round, so as to place the head to the fundus, the legs are brought down with much more difficulty than in the other case: but if the shoulder, breast, neck, ear, face, or crown of the head presents, and the legs and breech are up to the fundus uteri, the case is still more difficult; because, in the other two, the uterus is contracted in a round form, so that the wrong position of the child is more easily altered than in this, when the womb is contracted in a long shape, and sometimes requires vast force to stretch it, so as that the head may be raised to the fundus, and the legs and breech brought down.

The crown of the head is the worst part that can present, because in that case the feet and breech are higher, and the uterus of a longer form than in any other. The presentation of the face is, next to this, attended with the greatest difficulty: but when the neck, shoulder, back, or breast present, the head is turned upwards, and keeps the lower part of the womb distended: so that, upon stretching the upper part, the child's head is more easily raised to the fundus.

When the fore-parts of the child present, if the feet, hands, and navel-string are not detained above the os uteri, some or all of them descend into the vagina, or appear on the outside of the os externum. If one or more of them come down, and the child at the same time lies in a round form across the uterus, let the accoucheur introduce his hand between them and the sacrum. When it is past the os internum, let it rest a little, while he feels with his fingers the position of the fœtus: if the head and shoulders lie higher than the breech, he must take hold of the legs and bring them down without the os internum:

internum: if the breech is detained above the brim of the pelvis, let him slide up the flat of his hand along the buttocks, and pull down the legs with the other hand; by which method the breech is disengaged and forced into the middle of the pelvis. See Plate CXIII. fig. 3.

In most of those cases where the child is pressed in an oval form, if neither the head or breech present, the head is to one side of the uterus, and the breech to the other; because it is wider from side to side, than from the back to the fore part; and if either the head or breech is over the os pubis, the other is turned off to the side: in moving the head or shoulders to the fundus, they are raised with greater ease along the side, than at the back or fore parts, for the same reasons.

If the head and shoulders lie lower down, so as to hinder the breech from coming along, and the legs from being extracted, let him push up the head and shoulders to the fundus, and pull out the legs; then try to bring in the breech; and if it still sticks above, because the head and shoulders are again forced down by the contraction of the uterus, he must with one hand take hold of the legs that are now without the os externum, and, sliding the other into the uterus, push the head and shoulders again up to the fundus, while, at the same time, he pulls the legs and breech along with the feet. If the legs cannot be brought farther down than the vagina, because the breech is high up, let him slip a noose over the feet round the ancles, as before observed; by which he may pull down the lower parts with one hand, while the other is employed in pushing up, as before. By this double purchase, the child may be turned even in the most difficult cases: but the operator, in pulling, must beware of overstraining the ligaments of the joints.

If the legs can be extracted through the os externum, let a single cloth, warmed, be wrapped round them, in order to yield a firmer hold to the accoucheur; but when they can be brought no lower than the neck of the uterus and vagina, he may use one of these following nooses.

Let him take a strong limber fillet, or soft garter half-worn, about one yard and an half in length, and moderately broad and thick; if thick, an eye may be made at one end of it, by doubling about two inches and sewing it strongly; and the other end passed through this doubling, in order to make the noose; which being mounted upon the thumb and fingers of his hand, must be introduced, and gently slipped over the toes and feet of the child so as to embrace the ancles, and thus applied it must be drawn tight with his other hand.

If the foot or feet should be so slippery, that his fingers cannot hold them, and work over the noose at the same time, it must be withdrawn and mounted round his hand or wrist; with which hand, when introduced, he may take firm hold on both feet, if they are as far down as the vagina; then with the fingers of his other hand, he can slide the noose along the hand and fingers that hold the feet, and fix it round the ancle: but if one foot remains within the uterus, the fingers of his other hand cannot push up the noose far enough to slide it over the ancle; so that he must have recourse to a director, like that for polyposes, mounted with the noose, which will push it along the hand and fingers that hold the foot. The

noose being thus slipped over the fingers upon the ancles, he must pull the extremity of the fillet which hath passed the eye at the upper end of the director, and after it is close drawn, bring down the instrument.

If the fillet or garter is too narrow or thin, let it be doubled in the middle, and the noose made by passing the two ends through the doubling.

When the belly presents, and the head, shoulders, breech, thighs, and legs, are turned up over the back to the fundus uteri; when the back presents, and all these parts are upwards; when the side presents, with the head, shoulders, breech, thighs and legs turned to the side, back, or fore part of the uterus: In all these cases, when the child is pressed into a round, or (more properly) an oval figure, it may be, for the most part, moved round, with one hand introduced into the uterus, the head and shoulders pushed to the fundus, and the legs and breech to the os internum; which being effected, the legs are easily brought down. See Plate CXIII. fig. 4. But these cases are more or less difficult as the feet are farther up, or lower down, because the business is to bring them downwards.

When the breast, shoulders, neck, ear, or face present to the os internum, the breech, thighs, and legs being towards the fundus, with the fore parts of the fœtus turned either to the side, back, or fore-part of the woman's belly; and the whole lying in a longish form, the uterus being closely contracted around its body like a sheath; let the accoucheur introduce his hand into the vagina, and open the os internum by pushing up the fingers and hand flattened between the parts that present and the inside of the membranes; and rest his hand in that situation, until he can distinguish how the child lies, and form a right judgment how to turn and deliver; for, if these circumstances are not maturely considered, he will begin to work in a confused manner, fatigue himself and the patient, and find great difficulty in turning and extracting the child.

If the feet and legs of the fœtus lie towards the back, sides, or fundus uteri, the woman ought to be laid on her back, with her breech raised and brought a little over the bed, as formerly observed; because, in that position he can more easily reach the feet than in any other.

If they lie towards the fore part of the uterus, especially when the belly is pendulous, she ought to lie upon her side; because in the other posture, it is often difficult to turn the hand up to the fore-part of the womb; whereas, if she is laid on the left side, the right hand may be introduced at the upper part and left side of the brim of the pelvis, where it is widest, and then along the fore-part of the uterus, by which means the feet are more easily come at. If it is more convenient for the accoucheur to use his left hand, the patient may be turned on her right side. The only inconvenience attending these positions, is, that the woman cannot be kept so firm and steady, but will be apt to toss about and shrink from the operator: and besides, there may be a necessity for turning her upon her back, after the body is delivered, before he can extract the head, especially if it be large, or the pelvis narrow.

The situation of the child being known, and the position

of the mother adjusted, let the proper hand be introduced, and the first effort always made in pushing the presenting part up towards the fundus, either along the sides, back, or fore part of the uterus, as is most convenient. If this endeavour succeeds, and the breech, thighs, or legs come down, the body may be delivered with ease: but if the head, shoulder, breast, or neck present, the other parts of the body being stretched up lengthways, and the uterus so strongly contracted around the child, that the presenting part cannot be raised up, or, though pushed upwards, immediately returns before the legs can be properly seized or brought down; the operator ought, in that case, to force up his hand slowly and gradually between the uterus and the child: if the resistance is great, let him rest a little, between whiles, in order to save the strength of his hand and arm, and then proceed with his efforts until he shall advance his hand as far as the feet; for the higher his hand is pushed, the more will the uterus be stretched, and the more room granted for bringing the legs along: and if, in pushing up his hand, the fingers should be entangled in the navel-string or one of the arms, let him bring it a little lower, and pass it up again on the outside of such incumbrance.

The hand being advanced as high as the fundus, let him, after some pause, feel for the breech, slide his fingers along the thighs in search of the legs and feet; of which taking hold with his whole hand, if possible, let him bring them down either in a straight line or with a half turn: or should the contraction of the uterus be so strong, that he cannot take hold of them in that manner, let him seize one or both ankles between his fingers, and pull them along; but if he cannot bring them down to the lower part of the uterus, so as to apply the noose, he must try again to push up the body, in order still more to stretch the uterus, and obtain freer scope, to bring them down lower: then he may apply the noose, and turn the child as above directed, until the head and shoulders are raised up to the fundus, and the feet and breech delivered.

If one leg only can be brought down, the child being turned, and that member extracted through the os externum, let the accoucher slide his hand up to fetch the other; but, if this cannot be done, he must fix a finger on the outside of the groin of that thigh which is folded up along the belly, and bring along that buttock, as in the breech case, while he pulls with his other hand at the other leg; and the body being thus advanced, deliver as before directed.

When the shoulder presents, and the arm lies double in the vagina, let him push them both up; but, if this cannot be done, and the hand is prevented from passing along, he must bring down the arm, and hold it with one hand, while the other is introduced; then let go and push up the shoulder, and as the child is turned, and the feet brought down, the arm will for the most part return into the uterus: but if the arm that is come down, be so much swelled, that it is impracticable to introduce the hand, so as to turn and deliver the child, he must separate it at the joint of the shoulder, if it be so low down; or at the elbow, if he cannot reach the shoulder. If the limb be much mortified, it may be twisted off; otherwise, it may be snipt and separated with the scissars.

If the shoulder, by the imprudence and ignorance of the unskilful, who pull in expectation of delivering in that way, is forced into the vagina, and part of it appears on the outside of the os externum, a vast force is required to return it into the uterus; because, in this case, the shoulder, part of the ribs, breast, and side, are already pulled out of the uterus, which must be extended so as not only to receive them again, but also to admit the hand and arm of the accoucher. If this distension cannot possibly be effected, he must fix a crotchet above the sternum, and turn the child by pushing up the shoulder and pulling down with the crotchet; or slide his fingers to the neck of the child, and with the scissars divide the head from the body; then deliver first the separated head, or bring along the body by pulling at the arm, or, if need be, with the assistance of the crotchet.

When the forehead, face, or ear presents, and cannot be altered with the hand into the natural position; or is not advanced to the os externum, so as that we can assist with the forceps; the head must be returned, and the child delivered by the feet: but if this cannot be done, and the woman is in imminent danger, recourse must be had to the crotchet.

If the navel-string comes down by the child's head, and the pulsation is felt in the arteries, there is a necessity for turning without loss of time; for unless the head advances fast, and the delivery is quick, the circulation in the vessels will be entirely obstructed, and the child consequently perish. If the head is low in the pelvis, the forceps may be successfully used.

No doubt, if the pelvis is very narrow, or the head too large, it would be wrong to turn: in that case, we ought to try if we can possibly raise the head, so as to reduce the funis above it, and after that let the labour go on: but, if the waters are all gone, and a large portion of the funis falls down, it is impossible to raise it, so as to keep it up, even although we could easily raise the head; because, as one part of the funis is pushed up with the fingers, another part falls down, and evades the reduction; and to raise it up to the side, and not above the head, will be to no purpose; when a little only jets down at the side of the head, our endeavours will, for the most part, be successful.

The ancients, as well as some of the moderns, advise, in all cases when the upper parts, such as the shoulders, breast, neck, face, or ear of the child present, to push them upwards, and bring in the head as in the natural way; observing, that the fœtus ought never to be delivered by the feet, except in the presentation of the lower parts, such as the small of the back, belly, side, breech, or legs. Were it practicable at all times to bring the head into the right position, a great deal of fatigue would be saved to the operator, much pain to the woman, and imminent danger to the child: he therefore ought to attempt this method, and may succeed when he is called before the membranes are broke, and feels, by the touch, that the face, ear, or any of the upper parts, presents; in that case, let him open the os externum slowly during every pain, and when the os internum is sufficiently dilated by the descent of the waters and membranes, let him introduce his hand into the uterus, as before directed, betwixt the womb and the membranes, which must be broke;

broke; and if he finds the head so large, or the pelvis so narrow, that it will be difficult to save the child; provided the woman is vigorous and has strong pains, he may with little difficulty bring in the crown of the head, then withdraw his hand; and if the pains return and continue, the child has a good chance to be delivered alive. Even after the membranes are broke, if the presenting part hath so locked up the os internum, as to detain some portion of the waters (a circumstance easily known in pushing up the part that presents,) he may run up his hand speedily to keep them from being discharged, and act in the same manner: but if the child is not large, nor the pelvis narrow, it were pity, while his hand is in the uterus, to desist from turning the child and bringing it by the feet; because, in that case, he may be pretty certain of saving it. Besides, after the head is brought into the right position, should the pains go off entirely, (and this frequently happens,) or a flooding come on, in consequence of the force which hath been exerted, he will find great difficulty in turning after the waters have been discharged; for, it is harder to turn when the vertex presents, than in any other position; whereas, in the case of a large head or narrow pelvis, when the head is forced down by the labour-pains, and will not farther advance, the child may be saved by the forceps; nay, though the pains do not act so as to force it down, to be delivered either by the forceps or in the natural way, the head may be opened and extracted with the crotchet, which is the last resource.

But this necessity seldom occurs, because the cases in which we are most commonly called, are after the membranes have been long broke, the waters discharged, and the uterus strongly contracted around the body of the child, which it confines, as it were, in a mould: so that it is next to impossible to bring the head into the natural position; for this cannot be effected without first pushing up the part that presents, for which purpose great force is required; and as one hand only can be introduced, when the operator endeavours to bring in the head, the pushing force is abated, to allow the pulling force to act; and the parts that hindered the head from presenting are again forced down: besides, the head is so large and slippery, that he can obtain no firm hold. He might, indeed, by introducing a finger into the mouth, lay hold of the under jaw, and bring in the face, provided the shoulder presents; but, instead of amending, this would make the case worse, unless the child be very small: yet, granting the head could be brought into the natural position, the force necessarily exerted for this purpose would produce a flooding, which commonly weakens the patient, and carries off the pains; and after all, he must turn with less advantage: and if that cannot be performed when the head is brought in, he must have recourse to the last and most disagreeable method; whereas when any other part presents, we can always turn the child, and deliver it by the feet. This we cannot promise after the head is brought in; and once the operator's hand is in the uterus, he ought not to run such risks.

The child is often in danger, and sometimes lost, when the breech presents, and is low down in the pelvis, provided the thighs are so strongly pressed against the funis

and belly, as to stop the circulation in the rope; as also when the child is detained by the head, after the body is delivered: in both cases, the danger must be obviated by an expeditious delivery; and if the body is entangled in the navel-string, it must be disengaged as well as possible, especially when the funis happens to be between the thighs.

The legs and breech of the child being brought down, and the body properly turned with the fore-parts to the mother's back, let the accoucheur endeavour to bring it along; but, if it is detained by the size of the belly, distended with air or water, (a case that frequently happens when the child has been dead for several days,) let the belly be opened, by forcing into it the points of his scissars; or, he may tear it open with the sharp crotchet.

The body of the child being delivered, the arms brought down, and every method hitherto directed unsuccessfully used for the extraction of the head, which is detained by being naturally too large, over ossified, or dropsical, or from the narrowness and distortion of the pelvis; if the belly was not opened, and the child is found to be alive by the motion of the heart, or pulsation of the arteries in the funis, the forceps ought to be tried; but, if he finds it impracticable to deliver the head, so as to save the life of the child, he must, according to some, force the points of the scissars through the lower part of the occipital bone, or through the foramen magnum; then dilate the blades, so as to enlarge the opening, and introduce a blunt or sharp hook. This operation rarely succeeds when the head is over-ossified; but may answer the purpose when the bones are soft and yielding; or in the case of an hydrocephalus: because, in the first, the aperture may sometimes be enlarged, and in the other the water will be evacuated so as to diminish the bulk of the head, which will, of consequence, come along with more ease.

If, notwithstanding these endeavours, the head cannot be extracted, let the operator introduce his hand along the head, and his fingers through the os uteri; then slide up one of the curved crotchets along the ear, betwixt his hand and the child's head, upon the upper part of which it must be fixed: this being done, let him withdraw his hand, take hold of the instrument with one hand, turning the curve of it over the forehead, and with the other grasp the neck and shoulders, then pull along. The crotchet being thus fixed on the upper part, where the bones are thin and yielding, makes a large opening, through which the contents of the skull are emptied, the head collapsing is with more certainty extracted, and the instrument hath a firm hold to the last, at the forehead, os petrosum, and basis of the skull.

The excellency of *Mesnard's* contrivance is more conspicuous here than when the head presents; because the curvature of the crotchet allows the point to be fixed on the upper part of the skull, which is to be tore open; and in pulling, the contents are evacuated, and the head is lessened: by these means, the principal obstruction is removed. See Plate CXIII. fig. 8.

a, Represents a pair of curved crotchets locked together in the same manner as the forceps. The dotted lines along the inside of one of the blades represent a sheath contrived to guard the point till it is introduced

duced high enough; the ligature at the handles marked with the two dotted lines is then to be untied, the sheath withdrawn, and the point, being uncovered, is fixed as in Plate CXIII. fig. 5.

- b, Gives a view of the back part of one of the crotchets, which is 12 inches long.
- c, A front view of the point, to shew its proportional length and breadth.
- d, The scissars for perforating the cranium in very narrow and distorted pelvis's. They ought to be made very strong, and at least nine inches in length, with stops or rests in the middle of the blades, by which a large dilatation is more easily made.

If one crotchet be found insufficient, let him introduce the other in the same manner, along the opposite side, lock and join them together, and pull along, moving and turning the head, so as to humour the shape of the pelvis. This method seldom fails to accomplish his aim, though sometimes very great force is required; in which case, he must pull with leisure and caution.

But if all these expedients should fail, by reason of the extraordinary ossification or size of the head, or the narrowness and distortion of the pelvis, after having used the crotchets without success, he must separate the body from the head with a bistory or pair of scissars; then pushing up the head into the uterus, turn the face to the fundus, and the vertex down to the os internum and brim of the pelvis: let him direct an assistant to press upon the woman's belly with both hands, in order to keep the uterus and head firm in that position; then open the skull with the scissars, destroy the structure of the brain, and extract with the crotchets.

The head is sometimes left in the uterus by those practitioners, who not knowing how to turn the fore-parts and face of the child towards the back part of the uterus, or how to bring it along, although it presented in that position, pull at random with all their strength; so that the neck is stretched and separated, and the head left behind. This may also happen to an expert accoucheur, when the child hath been dead for many days, and the body is much mortified, even though he hath used all the necessary precautions.

In such a case, provided the head is not very large, nor the pelvis narrow, and the forehead is towards the sacrum, let him slide up his hand along the back-part of the pelvis, and introducing two fingers into the mouth, with the thumb below the chin, try to pull the forehead into the hollow of the sacrum: if it sticks at the jetting-in of that bone, he must endeavour to move it, first to one side, and then to the other. If the head is small, it will come along; if any fragment of the neck remains, or any part of the loose skin, he may lay hold on it, and assist delivery, by pulling at it with his other hand; if the head is low down, it may be extracted with the forceps.

Should all these methods fail, let him push up his hand along the side of the head, until it shall have passed the os internum; with the other hand, let him introduce one of the curved crotchets, and fix it upon the upper part of the head; then withdrawing the hand which was introduced, take hold on the instrument, and sliding the fingers of the other hand into the mouth, he must pull

down with both, as above directed. If the head is not over-ossified, the crotchet will tear open the skull; and the bulk being of consequence diminished, the whole may be brought along, even in a narrow pelvis: but if it cannot be moved, even by this expedient, he must introduce the other crotchet along the other side of the head, and fixing it upon the skull, lock them together; then in pulling, turn the fore-head down into the hollow of the sacrum, and extract with an half round turn upwards, as when delivering with the forceps.

If the forehead is towards the os pubis, and cannot be brought into the right position, let him with his hand push up the head into the uterus, turn the forehead from the anterior to the side or back part of it, and try to extract as before. If the child hath been dead some time, and is much mortified, he must pull cautiously at the under jaw, because, should that give way, he will have no other hold for pulling, or keeping the head steady when he attempts to extract with one crotchet.

When the head is so large, or the pelvis so narrow, that none of these methods will succeed, let him push up, and turning the upper parts downwards, direct an assistant to press the patient's belly with both hands, moving them from side to side, and squeezing in such a direction as will force the head towards the os internum, and retain it firmly in that position; then it must be opened and extracted.

Although, by these means, you may succeed in a few cases of this kind, yet as great difficulties may occur from inflammations of the pudenda, contraction of the uterus, slipperiness or largeness of the head, and the narrowness of the pelvis, it will not be improper to inform the reader of other methods that appear to be useful. Let the hand be introduced into the vagina, and if it cannot be admitted within the uterus, the fingers being insinuated, may move the head so as to raise the face and chin to the fundus, the vertex being turned to the os internum, and the forehead towards the side of the sacrum. This being effected, let the operator slide up along one ear a blade of the long forceps, which are curved to the side; then change hands, and send up the other blade along the opposite ear: when they are locked, and the handles secured by a fillet, he must pull the head as low as it will come; then putting them into the hands of an assistant, who will keep them in that position, let him make a large opening with the scissars, squeeze the head with great force, and extract slowly and by degrees.

Having turned down the vertex, as above directed, let *Leverol's* tire-tête, with the three sides joined together, be introduced along the accoucheur's hand to the upper part of the head; then let the sides or blades be opened with the other hand, so as to inclose the head, moving them circularly and lengthwise in a light and easy manner, that they may pass over the inequalities of the scalp, and avoid the resistance of the head and uterus: when they are exactly placed at equal distances from one another, let him join the handles, withdraw his hand, and tying them together with a fillet, pull down, open, and extract, as above directed; and let it be remembered, that the farther the hand can be introduced into the uterus, the more easily will both instruments be managed.

When

When the pelvis is large, or the head small, (in which cases this misfortune seldom happens,) without doubt we might succeed with *Mauriceau's* broad fillet or sling, provided it could be properly applied.

When the head is small, or the pelvis large, dilating the foramen magnum with the scissars, and introducing the blunt hook, may be of use either to pull the head along, or keep it down until we can fix the forceps, curve crotchet, or *Leveret's* tire-tête.

#### Of TWINS.

TWINS are supposed to be the effect of a double conception in one coition, when two or more ova are impregnated with as many animalcula; which descending from the ovarium, through the Fallopian tube, into the fundus uteri, as they increase, come in contact with that part, and with one another, and are so pressed as to form one globular figure, and stretch the womb into the same form which it assumes when distended by one ovum only; and that during the whole term of uterine gestation, it is impossible to distinguish twins, either by the figure and magnitude of the uterus, or by the motion of the different fetuses; for one child, when it is large, and surrounded with a great quantity of waters, will sometimes produce as large a prominence (or even larger) in the woman's belly, than is commonly observed when she is big with twins. One child will also, by moving its legs, arms, and other parts of its body, against different parts of the uterus, at the same instant, or by intervals, yield the same sensation to the mother, as may be observed in two or more children; for part of the motion in twins is employed on each other, as well as upon the uterus.

There is therefore no certain method of distinguishing in these cases, until the first child is delivered, and the accoucheur has examined if the placenta is coming along. If this comes of itself, and after its extraction the mouth of the womb be felt contracted, and the operator is unwilling to give unnecessary pain by introducing his hand into the uterus; let him lay his hand upon the woman's abdomen, and if nothing is left in the womb, he will generally feel it just above the os pubis, contracted into a firm round ball of the size of a child's head, or less: whereas, if there is another child left, the size will be found much larger. If the placenta does not come down before the second child, which is frequently the case, upon examining, he will commonly feel the membranes with the waters pushed down through the os uteri; or, if they are broke, the head or some part of the body will be felt. If, therefore, the woman has strong pains, and is in no danger from floodings or weakness, provided the head presents fair, and seems to come along, she will be delivered of this also in the natural way.

If the membranes are not broke, if the head does not immediately follow, or if the child presents wrong, he ought to turn and bring it immediately by the feet; in order to save the patient the fatigue of a second labour, that may prove tedious, and even dangerous, by enfeebling her too much. Besides, as the parts are fully opened by the first delivery, he can introduce his hand with ease; and as the membranes are, for the most part, whole, the wa-

ters may be kept up, and the foetus easily turned; but, if the pelvis is narrow, the woman strong, and the head presents, he ought to leave it to the efforts of nature.

If the child presents wrong, and, in turning that, he feels another, he must beware of breaking the membranes of one, while he is at work upon the other: but, should they chance to be broke, and the legs of both entangled together, (though this is seldom the case, because they are commonly divided by two sets of membranes,) let the operator, when he has got hold on two legs, run up his fingers to the breech, and feel if they belong to the same body; and one child being delivered, let the other be turned and brought out in the same manner. If there are more than two, the same method must take place, in extracting one after another.

In case of twins, the placenta of the first seldom comes along, until the second child is delivered; but, as this does not always happen, he ought, as formerly directed, to certify himself that there is nothing left in the uterus, when the cake comes of itself. Both children being delivered, let him extract both placentas, if they come not of themselves; and if they form distinct cakes, separate first one, then the other; but if they are joined together, forming but one mass, they may be delivered at once.

When there are three or four children, (a case that rarely happens,) the placentas are sometimes distinct, and sometimes all together form but one round cake; but, when this is macerated in water for some days, they, with their several membranes, may be easily separated from one another; for they only adhere in consequence of their long pressure in the uterus, and seldom have any communication of vessels.

Twins for the most part lie diagonally in the uterus, one below the other; so that they seldom obstruct one another at the os internum. See Plate CXI. fig. 5.

#### Of MONSTERS.

Two children joined together by their bellies, (which is the most common case of monstrous births,) or by the sides, or when the belly of the one adheres to the back of the other, having commonly but one funis, are comprehended in this class, and supposed to be the effect of two animalcula impregnating the same ovum, in which they grow together, and are nourished by one navel-string, originally belonging to the secundines; because, the vessels pertaining to the coats of the vein and arteries, do not anastomose with the vessels belonging to the foetus.

In such a case, where the children were small, the adhesion hath been known to stretch in pulling at the feet of one, so as to be delivered; and the other hath been afterwards brought along, in the same manner, without the necessity of a separation.

When the accoucheur is called to a case of this kind, if the children are large, and the woman come to her full time, let him first attempt to deliver them by that method: but if, after the legs and part of the body of the first are brought down, the rest will not follow, let him slide up his hand, and with his fingers examine the adhesion; then introducing the scissars between his hand and the body of the foetus, endeavour to separate them by slipping

snipping through the juncture. Should this attempt fail, he must diminish the bulk in the best manner he can think of, and bring the body of the fist, in different pieces, by pulling or cutting them asunder, as he extracts with the help of the crotchet.

No certain rules can be laid down in these cases, which seldom happen; and therefore a great deal must be left to the judgment and sagacity of the operator, who must regulate his conduct according to the circumstances of the case, and according to the directions given for delivering, when the pelvis is narrow and the children extraordinary large.

#### *Of the CÆSARIAN OPERATION.*

WHEN a woman cannot be delivered by any of the methods hitherto described and recommended in laborious and preternatural labours, on account of the narrowness or distortion of the pelvis, into which it is sometimes impossible to introduce the hand; or from large excrescences and glandular swellings, that fill up the vagina, and cannot be removed; or from large cicatrices and adhesions in that part, and at the os uteri, which cannot be separated; in such emergencies, if the woman is strong, and of a good habit of body, the Cæsarian operation is certainly advisable, and ought to be performed; because the mother and child have no other chance to be saved, and it is better to have recourse to an operation which hath sometimes succeeded, than leave them both to inevitable death. Nevertheless, if the woman is weak, exhausted with fruitless labour, violent floodings, or any other evacuation, which renders her recovery doubtful, even if she were delivered in the natural way: in these circumstances it would be rashness and presumption to attempt an operation of this kind, which ought to be delayed until the woman expires, and then immediately performed, with a view to save the child.

The operation hath been performed both in this and the last century, and sometimes with such success, that the mother has recovered, and the child survived. The previous steps to be taken, are to strengthen the patient, if weak, with nourishing broths and cordials; to evacuate the indurated fæces with repeated glysters; and, if the bladder is distended with urine, to draw it off with a catheter. These precautions being taken, she must be laid on her back, on a couch or bed, her side on which the incision is to be made being raised up by pillows placed below the opposite side: the operation may be performed on either side, though the left is commonly preferred to the right; because, in this last, the liver extends lower. The apparatus consists of a bistory, probe-scissors, large needles threaded, sponges, warm water, pledgets, a large tent or dossil, compresses, and a bandage for the belly.

If the weather is cold, the patient must be kept warm, and no part of the belly uncovered, except that on which the incision is to be made: if the operator be a young practitioner, the place may be marked by drawing a line along the middle space between the navel and the os ilium, about six or seven inches in length, slanting forwards towards the left groin, and beginning as high as the navel.

According to this direction, let him hold the skin of

the abdomen tense between the finger and thumb of one hand, and, with the bistory in the other, make a longitudinal incision through the cutis, to the membrana adiposa, which, with the muscles, must be slowly dissected and separated, until he reaches the peritonæum, which must be divided very cautiously, for fear of wounding the intestines that frequently start up at the sides, especially if the membranes are broke, the waters discharged, and the uterus contracted.

The peritonæum being laid bare, it may either be pinched up by the fingers, or slowly dissected with the bistory, until an opening is made sufficient to admit the fore-finger, which must be introduced as a director for the bistory or scissors in making an effectual dilatation. If the intestines push out, let them be pressed downwards, so as that the uterus may come in contact with the opening. If the womb is still distended with the waters, and at some distance from the child, the operator may make upon it a longitudinal incision at once; but if it is contracted close round the body of the fœtus, he must pinch it up, and dilate in the same cautious manner practised upon the peritonæum, taking care to avoid wounding the Fallopian tubes, ligaments, and bladder: then introducing his hand, he may take out the child and secundines. If the woman is strong, the uterus immediately contracts, so as that the opening, which at first extended to about six or seven inches, is reduced to two, or less; and in consequence of this contraction, the vessels being shrunk up, a great effusion of blood is prevented.

The coagulated blood being removed, and what is still fluid spunged up, the incision in the abdomen must be stitched with the interrupted suture, and sufficient room left between the last stitch and the lower end of the opening, for the discharge of the moisture and extravasated fluid. The wound may be dressed with dry pledgets or dossils dipped in some liquid balsam warmed, covered with compresses moistened with wine, and a bandage to keep on the dressings and sustain the belly. Some authors observe, that the cutis and muscles only should be taken up in the suture, lest bad symptoms should arise from stitching the peritonæum.

The woman must be kept in bed, as quiet as possible, and every thing administered to promote the lochia, perspiration, and sleep: which will prevent a fever and other dangerous symptoms. If she hath lost a great quantity of blood from the wounds in the uterus and abdomen, so as to be in danger from inanition, broths, caudles, and wine, ought to be given in small quantities, and frequently repeated; and the Peruvian bark administered in powder, decoction, or extract, may be of great service in this case.

*Of the management of women from the time of their delivery to the end of the month, with the several diseases to which they are subject during that period.*

#### *Of the EXTERNAL APPLICATION.*

THE woman being delivered of the child and placenta, let a soft linen cloth, warmed, be applied to the external parts; and if she complains much of a smarting soreness, some pomatum may be spread upon it. The linen that

that was laid below her, to sponge up the discharges, must be removed, and replaced with others that are clean, dry, and warm. Let her lie on her back, with her legs extended close to each other; or upon her side, if she thinks she can lie easier in that position, until she recovers from the fatigue: if she is spent and exhausted, let her take a little warm wine or caudle, or, according to the common custom, some nutmeg and sugar grated together in a spoon: the principal design of administering this powder, which among the good women is seldom neglected, is to supply the want of some cordial draught, when the patient is too weak to be raised, or supposed to be in danger of reachings from her stomach's being overloaded. When she hath in some measure recovered her strength and spirits, let the cloths be removed from the parts, and others applied in their room: and, if there is a large discharge from the uterus, let the wet linen below her be also shifted, that she may not run the risque of catching cold.

When the patient is either weak or faintish, she ought not to be taken out of bed, or even raised up to have her head and body shifted, until she is a little recruited; otherwise she will be in danger of repeated faintings, attended with convulsions, which sometimes end in death. To prevent these bad consequences, her skirt and petticoats ought to be loosened and pulled down over the legs, and replaced by another well warmed, with a broad headband to be slipt in below, and brought up over her thighs and hips: a warm double cloth must be laid on the belly, which is to be surrounded by the head band of the skirt pinned moderately tight over the cloth, in order to compress the viscera and the relaxed parietes of the abdomen, more or less, as the woman can easily bear it; by which means the uterus is kept firm in the lower part of the abdomen, and prevented from rolling from side to side when the patient is turned: but the principal end of this compression, is to hinder too great a quantity of blood from rushing into the relaxed vessels of the abdominal contents; especially when the uterus is emptied all of a sudden, by a quick delivery. The pressure being thus suddenly removed, the head is all at once robbed of its proportion of blood, and the immediate revulsion precipitates the patient into dangerous lypothymia.

For this reason the belly ought to be firmly compressed by the hands of an assistant, until the bandage is applied; or, in lieu of it, a long towel, sheet, or roller, to make a suitable compression: but, for this purpose, different methods are used in different countries, or according to the different circumstances of the patients. The head-cloaths and shift ought also to be changed, because with sweating in time of labour they are rendered wet and disagreeable. Several other applications are necessary, when the external or internal parts are rent or inflamed, misfortunes that sometimes happen in laborious and preternatural cases. See *MEDICINE*, p. 165, 166.

*Of Air, Diet, Sleeping and Watching, Motion and Rest, Retention and Excretion, and the Passions of the Mind.*

ALTHOUGH we cannot remove the patient immediately after delivery into another climate, we can qualify the

air, so as to keep it in a moderate and salutary temper, by rendering it warm or cold, moist or dry, according to the circumstances of the occasion. With regard to diet, women in time of labour, and even till the ninth day after delivery, ought to eat little solid food, and none at all during the first five or seven: let them drink plentifully of warm diluting fluids, such as barley water, gruel, chicken-water, and teas; caudles are also commonly used, composed of water gruel boiled up with mace and cinnamon, to which, when strained, is added a third or fourth part of white wine, or less, if the patient drinks plentifully; sweetened with sugar to their taste: this composition is termed white caudle; whereas, if ale is used instead of wine, it goes under the name of brown caudle. In some countries, eggs are added to both kinds; but, in that case, the woman is not permitted to eat meat or broths till after the fifth or seventh day: in this country, however, as eggs are no part of the ingredients, the patient is indulged with weak broth sooner, and sometimes allowed to eat a little boiled chicken. But all these different preparations are to be prescribed weaker or stronger, with regard to the spices, wine, or ale, according to the different constitutions and situations of different patients: for example, if she is low and weak, in consequence of an extraordinary discharge of any kind, either before or after delivery, or if the weather is cold, the caudles and broths may be made the stronger; but if she is of a full habit of body, and has the least tendency to a fever, or if the season is excessively hot, these drinks ought to be of a very weak consistence, or the patient restricted to gruel, tea, barley and chicken water, and these varied according to the emergency of the case.

Her food must be light and easy of digestion, such as panada, biscuit, and sago; about the fifth or seventh day she may eat a little boiled chicken, or the lightest kind of young meat: but, these last may be given sooner or later, according to the circumstances of the case, and the appetite of the patient. In the regimen as to eating and drinking, we should rather err on the abstemious side, than indulge the woman with meat and strong fermented liquors, even if these last should be most agreeable to her palate: for we find by experience, that they are apt to increase or bring on fevers, and that the most nourishing and salutary diet is that which we have above prescribed. Every thing that is difficult of digestion, or quickens the circulating fluids, must of necessity promote a fever; by which, the necessary discharges are obstructed, and the patient's life endangered.

As to the article of sleeping and watching, the patient must be kept as free from noise as possible, by covering the floors and stairs with carpets and cloths, oiling the hinges of the doors, silencing the bells, tying up the knockers, and in noisy streets throwing the pavement with straw; if, notwithstanding these precautions, she is disturbed, her ears must be stuffed with cotton, and opiates administered to procure sleep; because watching makes her restless, prevents perspiration, and promotes a fever.

Motion and rest are another part of the nonnaturals to which we ought to pay particular regard. By tossing about, getting out of bed, or sitting up too long, the perspiration is discouraged and interrupted; and in this last

attitude the uterus, not yet fully contracted, hangs down, stretching the ligaments, occasioning pain, cold shiverings, and a fever: for the prevention of these bad symptoms, the patient must be kept quiet in bed till after the fourth or fifth day, and then be gently lifted up in the bed-cloaths, in a lying posture, until the bed can be adjusted, into which she must be immediately re-conveyed, there to continue for the most part, till the ninth day, after which period women are not so subject to fevers, as immediately after delivery. Some there are, who, from the nature of their constitutions, or other accidents, recover more slowly; and such are to be treated with the same caution after, as before, the ninth day, as the case seems to indicate: others get up, walk about, and recover, in a much shorter time; but these may some time or other pay dearly for their foolhardiness, by encouraging dangerous fevers: so that we ought rather to err on the safe side, than run any risque whatsoever.

What next comes under consideration, is the circumstance of retention and excretion. We have formerly observed, that in time of labour, before the head of the child is locked into the pelvis, if the woman has not had easy passage in her belly that same day, the rectum and colon ought to be emptied by a glyster, which will assist the labour, prevent the disagreeable excretion of the fœces before the child's head, and enable the patient to remain two or three days after, without the necessity of going to stool. However, should this precaution be neglected, and the patient very costive after delivery, we must beware of throwing up stimulating glysters, or administering strong cathartics, lest they should bring on too many loose stools, which, if they cannot be stopt, sometimes produce fatal consequences, by obstructing the perspiration and lochia, and exhausting the woman, so as that she will die all of a sudden; a catastrophe which hath frequently happened from this practice. Wherefore, if it be necessary to empty the intestines, we ought to prescribe nothing but emollient glysters, or some very gentle opener, such as manna, or *Elect. Lenitivum*. But no excretion is of more consequence to the patient's recovery, than a free perspiration; which is so absolutely necessary, that unless she has a moisture continually on the surface of her body, for some days after the birth, she seldom recovers to advantage: her health, therefore, in a great measure depends upon her enjoying undisturbed repose, and a constant breathing sweat, which prevents a fever, by carrying off the tension, and assists the equal discharge of the lochia: and when these are obstructed, and a fever ensues with pain and restlessness, nothing relieves the patient so effectually as rest and profuse sweating, procured by opiates and sudorifics at the beginning of the complaints: yet these last must be more cautiously prescribed in excessive hot than in cool weather.

The last of the nonnaturals to be considered are the passions of the mind, which also require particular attention. The patient's imagination must not be disturbed by the news of any extraordinary accident which may have happened to her family or friends: for such information hath been known to carry off the labour-pains entirely, after they were begun, and the woman has sunk under her dejection of spirits: and even after delivery, these un-

seasonable communications have produced such anxiety as obstructed all the necessary excretions, and brought on a violent fever and convulsions, that ended in death.

#### *Of violent FLOODINGS.*

ALL women, when the placenta separates, and after it is delivered, lose more or less red blood, from the quantity of half a pound, to that of one pound, or even two; but should it exceed this proportion, and continue to flow without diminution, the patient is in great danger of her life: this hazardous hæmorrhage is known by the violence of the discharge, wetting fresh cloths as fast as they can be applied; from the pulse becoming low and weak, and the countenance turning pale; then the extremities grow cold, she sinks into faintings, and, if the discharge is not speedily stopt, or diminished, is seized with convulsions, which often terminate in death.

This dangerous efflux is occasioned by every thing that hinders the emptied uterus from contracting, such as great weakness and lassitude, in consequence of repeated floodings before delivery; the sudden evacuation of the uterus; sometimes, though seldom, it proceeds from part of the placenta's being left in the womb; it may happen when there is another child, or more, still undelivered; when the womb is kept distended with a large quantity of coagulated blood; or when it is inverted, by pulling too forcibly at the placenta.

In this case, as there is no time to be lost, and internal medicines cannot act so suddenly as to answer the purpose, we must have immediate recourse to external application. If the disorder be owing to weakness, by which the uterus is disabled from contracting itself, so that the mouths of the vessels are left open; or, though contracted a little, yet not enough to restrain the hæmorrhage of the thin blood; or if, in separating the placenta, the accoucheur has scratched or tore the inner surface or membrane of the womb; in these cases, such things must be used as will assist the contractile power of the uterus, and hinder the blood from flowing so fast into it and the neighbouring vessels; for this purpose, cloths dipped in any cold astringent fluid, such as oxycrate, or red tart wine, may be applied to the back and belly. Some prescribe venæsection in the arm, to the amount of five or six ounces, with a view of making revulsion: if the pulse is strong, this may be proper; otherwise, it will do more harm than good. Others order ligatures, for compressing the returning veins at the hams, arms, and neck, to retain as much blood as possible in the extremities and head. Besides these applications, the vagina may be filled with tow or linen rags, dipped in the above-mentioned liquids, in which a little allum, or *sachar-saturni* hath been dissolved: nay, some practitioners inject proof-spirits warmed, or, soaking them up in a rag or sponge, introduce and squeeze them into the uterus, in order to constrict the vessels.

If the flooding proceeds from another child, the retention of the placenta, or coagulated blood, these ought immediately to be extracted; and if there is an inversion of the uterus, it must be speedily reduced. Should the hæmorrhage, by these methods, abate a little, but still continue to flow, though not in such a quantity as to bring on sudden death, some red wine and jelly ought to

be prescribed for the patient, who should take it frequently, and a little at a time; but above all things, chicken or mutton broths, administered in the same manner, for fear of overloading the weakened stomach, and occasioning reachings: these repeated in small quantities, will gradually fill the exhausted vessels, and keep up the circulation. If the pulse continues strong, it will be proper to order repeated draughts of barley-water, acidulated with elixir vitriol: but if the circulation be weak and languid, extract of the bark, dissolved in *aq. cinnamomi tenuis*, and given in small draughts, or exhibited in any other form, will be serviceable; at the same time, lulling the patient to rest with opiates. These, indeed, when the first violence of the flood is abated, if properly and cautiously used, are generally more effectual than any other medicine.

#### *Of the AFTER-PAINS.*

AFTER PAINS commonly happen when the fibrous part of the blood is retained in the uterus or vagina, and formed into large clots, which are detained by the sudden contraction of the os internum and externum, after the placenta is delivered: or, if these should be extracted, others will sometimes be formed, though not so large as the first, because the cavity of the womb is continually diminishing after the birth. The uterus, in contracting, presses down these coagulums to the os internum; which being again gradually stretched, produces a degree of labour pains, owing to the irritation of its nerves: in consequence of this uneasiness, the woman squeezes the womb as in real labour; the force being increased, the clots are pushed along, and when they are delivered, she grows easy. The larger the quantity is of the coagulated blood, the feverer are the pains, and the longer they continue.

Women in the first child seldom have after-pains; because, after delivery, the womb is supposed to contract, and push off the clots with greater force in the first than in the following labours: after-pains may also proceed from obstructions in the vessels, and irritations at the os internum. In order to prevent or remove these pains, as soon as the placenta is separated and delivered, the hand being introduced into the uterus, may clear it of all the coagula. When the womb is felt through the parietes of the abdomen larger than usual, it may be taken for granted, that there is either another child, or a large quantity of this clotted blood; and, which soever it may be, there is a necessity for its being extracted. If the placenta comes away of itself, and the after-pains are violent, they may be alleviated and carried off by an opiate: for, by sleeping and sweating plentifully, the irritation is removed, the evacuations are increased, the os uteri is insensibly relaxed, and the coagula slide easily along. When the discharge of the lochia is small, the after-pains, if moderate, ought not to be restrained; because the squeezing which they occasion, promotes the other evacuation, which is necessary for the recovery of the patient. After-pains may also proceed from an obstruction in some of the vessels, occasioning a small inflammation of the os internum and ligaments; and the squeezing thereby occasioned, may not only help to propel the obstructing fluid, but al-

so (if not too violent) contribute to the natural discharges.

#### *Of the LOCHIA.*

We have already observed, that the delivery of the child and placenta is followed by an efflux of more or less blood, discharged from the uterus, which, by the immediate evacuation of the large vessels, is allowed to contract itself the more freely, without the danger of an inflammation, which would probably happen in the contraction, if the great vessels were not emptied at the same time: but, as the fluids in the smaller vessels cannot be so soon evacuated, or returned into the vena cava, it is necessary, that, after the great discharge is abated, a slow and gradual evacuation should continue, until the womb shall be contracted to near the same size which it had before pregnancy; and to this it attains about the eighteenth or twentieth day after delivery, though the period is different in different women.

When the large vessels are emptied immediately after delivery, the discharge frequently ceases for several hours, until the fluids in the smaller vessels are propelled into the larger, and then begins to flow again, of a paler colour.

The red colour of the lochia commonly continues till the fifth day, though it is always turning more and more ferous from the beginning; but, about the fifth day, it flows off a clear, or sometimes (though seldom) of a greenish tint; for, the mouths of the vessels growing gradually narrower, by the contraction of the uterus, at last allow the ferous part only to pass: as for the greenish hue, it is supposed to proceed from a dissolution of the cellular or cribriform membrane or mucus, that surrounded the surface of the placenta and chorion; part of which, being left in the uterus, becomes livid, decays, and, dissolving, mixes with and tinctures the discharge as it passes along.

Though the lochia, as we have already observed, commonly continue to the eighteenth or twentieth day, they are every day diminishing in quantity, and soonest cease in those women who suckle their children, or have had an extraordinary discharge at first; but the colour, quantity, and duration, differ in different women: in some patients, the red colour disappears on the first, or second day; and in others, though rarely, it continues more or less to the end of the month: the evacuation in some is very small, in others excessive: in one woman it ceases very soon, in another flows during the whole month: yet, all of these patients shall do well.

Some alledge, that this discharge from the uterus is the same with that from a wound of a large surface: but it is more reasonable to suppose, that the change of colour and diminution of quantity proceed from the slow contraction of the vessels; because, previous to pus, there must have been lacerations or imposthumes, and in women who have suddenly died after delivery no wound or excoriation hath appeared upon the inner surface of the womb, which is sometimes found altogether smooth, and at other times rough and unequal on that part to which the placenta adhered. The space that is occupied before delivery, from being six inches in diameter, or eighteen inches, in circumference, will, soon after the birth, be contracted to one third or fourth of these dimensions.

*Of the MILK FEVER.*

ABOUT the fourth day, the breasts generally begin to grow turgid and painful. We have formerly observed, that, during the time of uterine gestation, the breasts in most women gradually increase till the delivery, growing softer as they are enlarged by the vessels being more and more filled with fluids; and by this gradual distention they are prepared for secreting the milk from the blood, after delivery. During the two or three first days after parturition, especially when the woman has undergone a large discharge, the breasts have been sometimes observed to subside and grow flaccid; and about the third or fourth day, when the lochia begin to decrease, the breasts swell again to their former size, and stretch more, and more, until the milk, being secreted, is either sucked by the child, or frequently of itself runs out at the nipples.

Most of the complaints incident to women after delivery, proceed either from the obstruction of the lochia in the uterus, or of the milk in the breasts, occasioned by any thing that will produce a fever; such as catching cold, long and severe labour, eating food that is hard of digestion, and drinking fluids that quicken the circulation of the blood in the large vessels; by which means the smaller, with all the secretory and excretory ducts, are obstructed.

The discharge of the lochia being so different in women of different constitutions, and besides in some measure depending upon the method of management, and the way of life peculiar to the patient, we are not to judge of her situation from the colour, quantity, and duration of them, but from the other symptoms that attend the discharge; and if the woman seems hearty, and in a fair way of recovery, nothing ought to be done with a view to augment or diminish the evacuation. If the discharge be greater than she can bear, it will be attended with all the symptoms of inanition; but as the lochia seldom flow so violently as to destroy the patient of a sudden, she may be supported by a proper nourishing diet, assisted with cordial and restorative medicines. Let her, for example, use broths, jellies, and asses milk; if the pulse is languid and sunk, she may take repeated doses of the *confect. cardiac.* with mixtures composed of the cordial waters and volatile spirits: subastringents and opiates frequently administered, with the *cort. Peruvian.* in different forms, and austere wines, are of great service. On the other hand, when the discharge is too small, or hath ceased altogether, the symptoms are more dangerous, and require the contrary method of cure: for now the business is to remove a too great plenitude of the vessels in and about the uterus, occasioning tension, pain, and labour, in the circulating fluids; from whence proceed great heat in the part, restlessness, fever, a full, hard, quick pulse, pains in the head and back, nausea, and difficulty in breathing. These complaints, if not at first prevented, or removed by rest and plentiful sweating, must be treated with venesection and the antiphlogistic method.

When the obstruction is recent, let the patient lie quiet, and encourage a plentiful diaphoresis, by drinking

frequently of warm, weak, diluting fluids, such as water-gruel, barley-water, tea, or weak chicken-broth.

Should these methods be used without success, and the patient, far from being relieved by rest, plentiful sweating, or a sufficient discharge of the obstructed lochia, labour under an hot dry skin, anxiety, and a quick, hard, and full pulse, the warm diaphoretics must be laid aside; because, if they fail of having the desired effect, they must necessarily increase the fever and obstruction, and recourse be had to bleeding at the arm or ankle to more or less quantity, according to the degree of fever and obstruction; and this evacuation must be repeated as there is occasion. When the obstruction is not total, it is supposed more proper to bleed at the ankle than at the arm; and at this last, when the discharge is altogether stopped. Her ordinary drink ought to be impregnated with nitre.

If she is costive, emollient and gently opening glysters may be occasionally injected; and her breasts must be fomented and sucked, either by the mouth or pipe-glasses. If, by these means, the fever is abated, and the necessary discharges return, the patient commonly recovers; but, if the complaints continue, the antiphlogistic method must still be pursued. If, notwithstanding these efforts, the fever is not diminished or removed by a plentiful discharge of the lochia from the uterus, the milk from the breasts, or by a critical evacuation by sweat, urine, or stool, and the woman is every now and then attacked with cold shiverings; an abscess or abscesses will probably be formed in the uterus or neighbouring parts, or in the breasts; and sometimes, the matter will be translated to other situations, and the seat of it foretold from the part's being affected with violent pains: these abscesses are more or less dangerous, according to the place in which they happen, the largeness of the suppuration, and the good or bad constitution of the patient.

If when the pains in the epigastric region are violent, and the fever increased to a very high degree, the patient should all of a sudden enjoy a cessation from pain, without any previous discharge or critical emption, the physician may pronounce that a mortification is begun; especially if, at the same time, the pulse becomes low, quick, wavering, and intermitting: if the woman's countenance, from being florid, turns dusky and pale, while she herself, and all the attendants, conceive her much mended; in that case, she will grow delirious, and die in a very short time.

What we have said on this subject, regards that fever which proceeds from the obstructed lochia, and in which the breasts may likewise be affected: but the milk fever is that in which the breasts are originally concerned, and which may happen though the lochia continue to flow in sufficient quantity; nevertheless, they mutually promote each other, and both are to be treated in the manner already explained; namely, by opiates, diluents, and diaphoretics, in the beginning; and, these prescriptions failing, the obstructions must be resolved by the antiphlogistic method described above. The milk-fever alone, when the uterus is not concerned, is not so dangerous, and much more easily relieved. Women of an healthy constitution, who suckle their own children, have good nipples,

ples, and whose milk comes freely, are seldom or never subject to this disorder, which is more incident to those who do not give suck, and neglect to prevent the secretion in time; or, when the milk is secreted, take no measures for emptying their breasts. This fever likewise happens to women who try too soon to suckle, and continue their efforts too long at one time; by which means, the nipples, and consequently the breasts, are often inflamed, swelled, and obstructed.

In order to prevent too great a turgency in the vessels of the breasts, and the secretion of milk, in those women who do not chuse to suckle, it will be proper to make external application of those things which by their pressure and repercussive force will hinder the blood from flowing in too great quantity to this part, which is now more yielding than at any other time: for this purpose, let the breasts be covered with *emp. de minio, diapalma*, or *emp. simp.* spread upon linen, or cloths dipped in camphorated spirits, be frequently applied to these parts and the armpits; while the patient's diet and drink is of the lightest kind, and given in small quantities. Notwithstanding these precautions, a turgency commonly begins about the third day; but by rest, moderate sweating, and the use of these applications, the tension and pain will subside about the fifth or sixth day, especially if the milk runs out at the nipples: but if the woman catches cold, or is of a full habit of body, and not very abstemious, the tension and pain increasing, will bring on a cold-shivering succeeded by a fever; which may obstruct the other excretions, as well as those of the breast.

In this case, the sudorifics above recommended must be prescribed; and if a plentiful sweat ensues, the patient will be relieved; at the same time the milk must be extracted from her breasts, by sucking with the mouth or glasses: should these methods fail, and the fever increase, she ought to be bled in the arm; and instead of the external applications hitherto used, emollient liniments and cataplasms must be substituted, in order to soften and relax. If, in spite of these endeavours, the fever proceeds for some days, the patient is frequently relieved by critical sweats, a large discharge from the uterus, military eruptions, or loose stools mixed with milk, which is curdled in the intestines; but, should none of these eva-

cuations happen, and the inflammation continue with increasing violence, there is danger of an imposthume, which is to be brought to maturity, and managed like other inflammatory tumours; and no astringents ought to be applied, lest they should produce schirrhous swellings in the glands.

As the crisis of this fever, as well as of that last described, often consists in military eruptions over the whole surface of the body, but particularly on the neck and breast, by which the fever is carried off, nothing ought to be given, which will either greatly increase or diminish the circulating force, but such only as will keep out the eruptions. But if, notwithstanding these eruptions, the fever, instead of abating, is augmented, it will be necessary to diminish its force, and prevent its increase, by those evacuations we have mentioned above. On the contrary, should the pulse sink, the eruptions begin to retreat inwardly, and the morbid matter be in danger of falling upon the viscera, we must endeavour to keep them out, by opiates and sudorific medicines; and here blisters may be applied with success.

*Of the Evacuations necessary at the end of the Month after Delivery.*

THOSE who have had a sufficient discharge of the lochia, plenty of milk, and suckle their own children, commonly recover with ease; and as the superfluous fluids of the body are drained off at the nipples, seldom require evacuations at the end of the month: but if there are any complaints from fullness, such as pains and stitches, after the twentieth day, some blood ought to be taken from the arm, and the belly gently opened by frequent glysters, or repeated doses of laxative medicines.

If the patient has tolerably recovered, the milk having been at first sucked or discharged from the nipples, and afterwards discussed, no evacuations are necessary before the third or fourth week; and sometimes not till after the first flowing of the menses, which commonly happens about the fifth week; if they do not appear within that time, gentle evacuations must be prescribed, to carry off the plethora, and bring down the catamenia.

## M I L

MIGRATION, the passage or removal of a thing out of one place or state into another.

MILAN, the capital of the Milanese, or dutchy of Milan, in Italy: E. long. 9° 30', N. lat. 45° 25'.

MILBORN-PORT, a borough-town of Somersetshire, twenty-five miles south of Bath. It sends two members to parliament.

MILDEW, a disease happening to plants, caused by a dewy moisture supposed by some to be a species of blight.

MILE, *mille passus*, a measure of length or distance, containing eight furlongs, &c.

The English statute-mile is fourscore chains, or 1760 yards; that is, 5280 feet.

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## M I L

We shall here give a table of the miles in use among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

	Geometrical paces.
Mile of Russia	750
of Italy	1000
of England	1250
of Scotland and Ireland	1500
Old league of France	1500
The small league, <i>ibid.</i>	2000
The mean league, <i>ibid.</i>	2500
The great league of France	3000
Mile of Poland	3000
of Spain	3248
	3 Q
	Mile

Geometrical paces.

Mile of Germany	4000
of Denmark	5000
of Hungary	6000

**MILFORD HAVEN**, the most commodious harbour in Great Britain, situated in the south west part of Pembrokehire in Wales, at the north entrance of the Bristol channel.

**MILIARY**, in general, something resembling millet-seeds.

**MILIARY FEVER**. See **MEDICINE**, p. 73.

**MILITANT**, or **CHURCH MILITANT**, denotes the body of Christians while here on earth.

**MILITARY**, something belonging to the soldiery or militia.

**MILITIA**, in general, denotes the body of soldiers, or those who make profession of arms.

In a more restrained sense, militia denotes the trained bands of a town or country, who arm themselves, upon a short warning, for their own defence. So that, in this sense, militia is opposed to regular or stated troops.

For the direction and command of the militia, the king constitutes lords-lieutenants of each county.

**MILUUM**, in botany, a genus of the triandria digynia class. The corolla consists of two valves including one flower. There are five species, only one of which, *viz.* the effusum, or millet-grass, is a native of Britain.

**MILK**, a well known animal fluid, which nature prepares in the breasts of women, and the udders of other animals, for the nourishment of their young. Milk is a liquor prepared from the aliment chewed in the mouth, digested in the stomach, perfected by the force and juices of the intestines, and elaborated by means of the mesentery and its gland and juices, and the juices of the thoracic duct. It has undergone some actions of the veins, arteries, heart, lungs, and juices, and began to be assimilated; yet may still be had separate and discharged out of the body. And thus by their own milk, prepared from the proper matter of the chyle, all the known lactiferous animals are nourished, both male and female. For milk is always prepared from chyle as well in men as in women, in virgins and barren women, in mothers and nurses. Milk approaches nearer to an animal nature than chyle.

If milk be good, and suffered to rest in a clean vessel, it first appears uniformly white; then throws up a white, thick, unctuous cream to its surface, and remains somewhat bluish below. The milks of all the known animals have these properties alike. The human milk is very sweet and thin, the next is that of asses, then that of mares, then of goats, and lastly of cows: whence it is prescribed in this order to consumptive persons of weak viscera. The rennet prepared of the juices of such creatures as chew the cud being mixed with milk, coagulates it into an uniform mass, which may be cut with a knife, and it thus spontaneously separates into whey and curds; if long boiled over the fire, it loses its more fluid parts, and condenses into a butyraceous and cheesy mass.

Milk is an efficacious remedy in disorders of the breast. But it is to be observed, that all milks are not of the same kind, and of the same efficacy for all purposes; since, according to the diversity of animals and their respective foods, they are possessed of different and peculiar qualities which are to be considered apart. First, then, asses milk, contains a great deal of sweet serum, but a very small quantity of earthy, caseous, and pinguous substance; for which reason it is not easily coagulated, and, consequently, but very unfit for butter and cheese. Its whey is astringent, laxative, moistening, and proper for correcting the acrimony of the humours. Goats milk does not contain so large a quantity of whey as that of asses, nor is it of so laxative and astringent a nature, but of a thicker consistence; and, as goats eat the leaves of trees which contain something of a resinous quality, their milk is very efficacious for the consolidation of suppurated parts. Cows-milk is more pinguous, contains a large quantity of earth, but less whey, for which reason it generally yields a great deal of butter and cheese. This species of milk is of a tempering, nutritive and consolidating virtue. Womens milk, for medicinal purposes, is preferable to all others; for it is the sweetest of them all, and its nutritive quality is sufficiently observable in infants. The virtues of milk are also different, according to the diversity of herbs and pasturage which animals eat. Hence milk in the spring is highly salutary, because at that time the vegetables abound with temperate juices; whereas milk in the winter is accounted less salutary, because the animals feed on hay and straw.

Dr. Cheyne recommends a milk and seed diet, with water for drink, as the surest preservative against diseases, and cure of them.

**MILK FEVER**. See **MIDWIFERY**, p. 244.

**MILL**, a machine or engine for grinding corn, &c. of which there are several kinds, according to the various methods of applying the moving power; as water-mills, wind-mills, mills worked by horses, &c. See **MECHANICS**.

**MILLENARIANS**, or **CHILIASTS**, a name given to those, who, in the primitive ages, believed that the saints will one day reign on earth with Jesus Christ a thousand years.

**MILLEPES**. See **ONISCUS**.

**MILLERIA**, a genus of the syngenesia polygamia necessaria class. It has neither receptacle nor pappus; the calix consists of three valves; and the radius of the corolla is dimidiated. There are two species, both natives of America.

**MILLET**, in botany. See **MILUUM**.

**MILLING** of cloth. See **FULLING**.

**MILLION**, in arithmetick, the number of ten hundred thousand, or a thousand times a thousand. See **ARITHMETICK**.

**MILLREE**, a Portuguese gold coin, value 5 r 7½ d.

**MILO**, or **MELo**, one of the islands of the Archipelago, sixty miles north of Candia.

**MILT**, or **MELT**, is a denomination by which some call the rows of fishes.

**MILTON**,

MILTON, the name of several market towns, as one twelve miles north-east of Dorchester, and another twelve miles north-east of Maidstone.

MILVUS, in ornithology. See *FALCO*.

MIME, in the ancient comedy, a person who acted any character by mere gestures, and hence denominated pantomime. See *PANTOMIME*.

MIMESIS, in rhetoric, the imitating the voice and gestures of another person.

MIMOSA, the SENSITIVE PLANT, in botany, a genus of the polygamia monœcia class. The calix of the hermaphrodite consists of five teeth, and the corolla of five segments; it has five or more stamina, one pistillum, and the fruit is a pod; the calix, corolla, and stamina of the male are the same with those of the female. There are 43 species, all natives of the Indies.—The mimosa is called the sensitive plant from its remarkable property of shrinking its leaves and branches upon being touched by the hand or any thing else. This motion it performs by means of three distinct articulations, *viz.* of a single leaf with its pedicle, of the pedicle to its branch, and of the branch to the trunk or main stem: the primary motion of all which is the closing of the two halves of the leaf on its rib; then the rib or pedicle itself closes; and if the motion wherewith the plant is moved be very strong, the very branches have the sensation propagated to them, and apply themselves to the main stem, as the simple leaves did before to their ribs, and these ribs to their branches; so that the whole plant, in this state, forms itself, from a very complexly branched figure, into a sort of straight cylindrical one.

Many attempts have been made to account for the motion of this plant upon mechanical principles; but all these attempts have hitherto proved unsatisfactory.

MIMULUS, in botany, a genus of the didynamia angiospermia class. The calix is prismatical, and consists of four teeth; the corolla is ringent, having the edges of the upper lip bent downwards; and the capsule has two cells, containing many seeds. There are two species, both natives of America.

MIMUSOPS, in botany, a genus of the octandria monogynia class. The calix consists of eight leaves, and the corolla of eight petals; and the drupa is pointed. There are two species, both natives of India.

MINA, in Grecian antiquity, a money of account, equal to an hundred drachms.

MIND, a thinking intelligent being, otherwise called spirit, in opposition to matter or body.

The culture of the human mind is more immediately taught in the sciences of logic and morals. See *LOGIC* and *MORALS*.

MINDANAO, the largest of the Philippine islands, except Luconia, is situated between 120° and 126° east longitude, and between 5° and 10° N. lat.

MINDELHEIM, a city of Germany, thirty-three miles south east of Ulm. It is the capital of the principality of Mindelheim, conferred on the duke of Moriborough, by the emperor in 1704.

MINDEN, a city of Germany, the capital of a duchy

of the same name, situated forty miles west of Hanover.

MINDORA, one of the Philippine islands, lies south-west of Luconia, from which it is separated by a narrow channel.

MINE, in natural history, a place under ground, where metals, minerals, or even precious stones are dug up.

As, therefore, the matter dug out of mines is various, the mines themselves acquire various denominations, as gold mines, silver mines, copper mines, iron mines, diamond mines, salt mines, mines of antimony, of alum, &c.

Mines, then, in general, are veins or cavities within the earth, whose sides receding from, or approaching nearer to each other, make them of unequal breadths in different places, sometimes forming larger spaces which are called holes: they are filled with substances, which, whether metallic or of any other nature, are called the loads; when the substances forming these loads, are reducible to metal, the loads are by the miners said to be alive, otherwise they are called dead loads. In Cornwall and Devon, the loads always hold their course from eastward to westward; though in other parts of England, they frequently run from north to south. The miners report, that the sides of the load never bear in a perpendicular, but constantly under-ly either to the north or to the south. The load is frequently intercepted by the crossing of a vein of earth, or stone, or some different metallic substance; in which case it generally happens that one part of the load is moved a considerable distance to the one side. This transient load is by the miners called *flooding*; and the part of the lead which is to be moved, is said to be *heaved*.

According to Dr Nicols's observations upon mines, they seem to be, or to have been, the channels thro' which the waters pass within the earth, and, like rivers, have their small branches opening into them, in all directions. Most mines have streams of water running through them; and when they are found dry, it seems to be owing to the waters having changed their course, as being obliged to it, either because the load has stopped up the ancient passages, or that some new and more easy ones are made.

Mines, says Dr Shaw, are liable to many contingencies; being sometimes poor, sometimes soon exhaustible, sometimes subject to be drowned, especially when deep, and sometimes hard to trace; yet there are many instances of mines proving highly advantageous for hundreds of years: the mines of Potosi are to this day worked with nearly the same success as at first; the gold mines of Crennitz have been worked almost these thousand years; and our Cornish tin mines are extremely ancient. The neat profit of the silver alone, dug in the Misnian silver-mines in Saxony, is still, in the space of eight years, computed at a thousand six hundred and forty-four millions, besides seventy-three tons of gold. Many mines have been discovered by accident: a torrent first laid open a rich vein of the silver mine at Friburg in Germany; sometimes a violent

violent wind, by blowing up trees, or overturning the parts of rocks, has discovered a mine; the same has happened by violent showers, earthquakes, thunder, the firing of woods, or even the stroke of a ploughshare or horse's hoof.

But the art of mining does not wait for these favourable accidents, but directly goes upon the search and discovery of such mineral veins, ores, or sands, as may be worth the working for metal. The principal investigation and discovery of mines depend upon a particular sagacity, or acquired habit of judging from particular signs, that metallic matters are contained in certain parts of the earth, not far below its surface. The principal signs of a latent metallic vein, seem reducible to general heads; such as, 1. The discovery of certain mineral waters. 2. The discolouration of the trees or grass of a place. 3. The finding of pieces of ore on the surface of the ground. 4. The rise of warm exhalations. 5. The finding of metallic sands, and the like. All which are so many encouragements for making a stricter search near the places where any thing of this kind appears; whence rules of practice might be formed for reducing this art to a greater certainty. But when no evident marks of a mine appears, the skilful mineralist usually bores into the earth, in such places as from some analogy of knowledge, gained by experience, or by observing the situation, course, or nature of other mines, he judges may contain metal.

After the mine is found, the next thing to be considered, is whether it may be dug to advantage. In order to determine this, we are duly to weigh the nature of the place, and its situation, as to wood, water, carriage, healthiness, and the like; and compare the result with the richness of the ore, the charge of digging, stamping, washing, and smelting.

Particularly the form and situation of the spot should be well considered. A mine must either happen, 1. In a mountain. 2. In a hill. 3. In a valley. Or, 4. In a flat. But mountains and hills are dug with much greater ease and convenience, chiefly because the drains and burrows, that is, the adits or avenues, may be here readily cut, both to drain the water and to form gang-ways for bringing out the lead, &c. In all the four cases we are to look out for the veins which the rains, or other accidental thing, may have laid bare; and if such a vein be found, it may often be proper to open the mine at that place, especially if the vein prove tolerably large and rich: otherwise the most commodious place for situation is to be chose for the purpose, *viz.* neither on a flat, nor on the tops of mountains, but on the sides. The best situation for a mine, is a mountainous, woody, wholesome spot; of a safe easy ascent, and bordering on a navigable river. The places abounding with mines are generally healthy, as standing high, and every where exposed to the air; yet some places, where mines are found, prove poisonous, and can, upon no account, be dug, though ever so rich: the way of examining a suspected place of this kind, is to make experiments upon brutes, by

exposing them to the effluvia or exhalations, to find the effects.

Devonshire and Cornwall, where there are a great many mines of copper and tin, is a very mountainous country, which gives an opportunity in many places to make adits, or subterraneous drains, to some valley at a distance, by which to carry off the water from the mine, which otherwise would drown them out from getting the ore. These adits are sometimes carried a mile or two, and dug at a vast expence, as from 2000 l. to 4000 l. especially where the ground is rocky; and yet they find this cheaper than to draw up the water out of the mine quite to the top, when the water runs in plenty, and the mine is deep. Sometimes, indeed, they cannot find a level near enough, to which an adit may be carried from the very bottom of the mine; yet they find it worth while to make an adit at half the height to which the water is to be raised, thereby saving half the expence.

The late Mr Costar, considering that sometimes from small streams, and sometimes from little springs, or collections of rain-water, one might have a pretty deal of water above ground, though not a sufficient quantity to turn an overshot-wheel, thought, that if a sufficient fall might be had, this collection of water might be made useful in raising the water in a mine to the adit, where it may be carried off.

**MINE**, in the military art, denotes a subterraneous canal, or passage, dug under the wall or rampart of a fortification, intended to be blown up by gun-powder.

The alley or passage of a mine is commonly about four feet square; at the end of this is the chamber of the mine, which is a cavity about five feet in width and in length, and about six feet in height; and here the gun-powder is stowed. The faucet of the mine, is the train, for which there is always a little aperture left. There are various kinds of mines, which acquire various names, as royal mines, serpentine-mines, forked mines, according as their passages are straight, oblique, winding, &c.

**MINEHEAD**, a borough and port town of Somersetshire, which sends two members to parliament: W. long.  $3^{\circ} 20'$ , N. lat.  $51^{\circ} 18'$ .

**MINERAL**, in natural history, is used, in general, for all fossil bodies, whether simple or compound, dug out of a subterraneous mine, from which it takes its denomination.

**MINERAL Waters**, in medicine, all those wherein any medicinal virtues, besides those of common water, are found.

These mineral waters are of various kinds, but they are considered under the general titles of chalybeate, purgative, and alterative. The more useful and commodious additions for examining these three kinds of mineral waters, are, according to Dr Shaw, galls, syrup of violets, and oil of tartar per deliquium. Galls discover in them any small proportion of vitriol or dissolved iron, as having the property of immediately striking a purple or black colour in all waters where any such substance is lodged. Spirit of violet, in the same

same manner, discovers any small predominancy of an acid or alkali therein, by changing the water red if acid, and green if alkali prevails. Oil of tartar discovers any small proportion of earthy matter less capable of dissolving in water than that salt, by precipitating such earthy matter in form of a white cloud to the bottom of the containing glass, where it collects and appears like a subtile white powder.

These particulars may be shewn, and proved satisfactorily, by adding to pure water a little of a known acid, alkali, dissolved iron, and subtile earth, or fine light sediment of an earthy water; applying the syrup of violets, galls, and oil of tartar respectively.

Mineral waters are imitable by art. The rule is, by a proper analysis to find the contents of such water (by evaporation, the addition of tinging ingredients, &c. as above mentioned) and their proportions; then, by means of synthetical chemistry, to compose a similar mixture: thus, for example, we learn by a proper analysis, that the ingredients, or different constituent parts of Pyrmont waters, are a subtile aqueous fluid, a volatile iron, and a predominating alkali, all joined together in one brisk pungent spirituous water. The imitation of this kind of chalybeate water, is by much the most difficult, and may perhaps be rendered most perfect, by boiling the purest common water in a close vessel, with a small proportion of ochre, soft iron ore, or pyrites.

The imitation of the common purgative mineral waters is easy: thus Epsom water is imitated by barely dissolving three or four drams of Epsom salt in a quart of pure water, made somewhat brisk or quick with a few drops of spirit of vitriol and oil of tartar per deliquium, so as to let the alkali prevail.

The imitation of the alterative waters, such as those of Bath, Buxton, &c. has hitherto scarce been attempted, nor can be rationally, for want of their respective just analysis, upon which such imitation should always be grounded.

As to the use of mineral waters, the learned Heister observes, that in general they are found to agree much better with persons in the middle stages of life, than with persons very old or very young. If any general rule can be given in this case, it is, that people should not take them when younger than eighteen, or older than sixty.

**MINERVALIA**, in Roman antiquity, festivals celebrated in honour of Minerva, in the month of March; at which time the scholars had a vacation, and usually made a present to their masters, called, from this festival, *minerval*.

**MINHO**, a great river of Spain, which taking its rise in Galicia, divides that province from Portugal, and falls into the Atlantic at Camoeba.

**MINIATURE**, a delicate kind of painting, distinguished from all others by the smallness of the figures, its being performed with dots or points instead of lines; by the faintness of the colouring; its requiring to be viewed very near: and by its being usually done on vellum.

This is the nicest and most tedious of all kinds of  
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painting, being performed wholly with the point of the pencil: for when the colours are laid on flat without dotting, though the figures be small, and the ground either vellum or paper, it is not called painting in miniature, but washing. There are some painters who never use any white colour in painting in miniature, but make the ground of the vellum serve to raise their figures; in which case the lights appear bright in proportion to the depth and strength of the colours of the figures. Others, before they go to work, give the vellum a light wash with white lead well prepared and purified. These colours that have the least body, are the best and most commodious for painting in miniature; as carmine, ultramarine, fine lakes, and greens made of herbs and flowers: but besides these, the following colours are also made use of, *viz.* vermilion, black lead, brown red, masticote pale, yellow masticote, indigo, ivory black, lamp black, Spanish brown, umber, gall stone, brown ochre, French pink, orpiment, gamboge, Naples yellow, bladder-green, verditer, sea-green, German ashes, flake white, and white lead. All terrene colours, and other gross substances, are too coarse for fine work, how well-soever they may be ground: but the finest particles may be separated by tempering the colour in a cup of fair water; and having stirred it well with your finger, and the whole being thoroughly mixed, let it subside for a while, and then pour it by inclination into a shell that has been well scoured in hot water, and let it stand to dry. Yellow ochre, brown red, umber, and ultramarine, purify by fire; but if they are burnt in too fierce a fire, they change, and the brown red turns yellow, the yellow ochre and umber turn reddish, and so of the rest: if the fire is not too fierce, it renders them softer and kinder than before, so that the finest and purest ultramarine, burnt in a red hot shovel, becomes much more brilliant than it was before it was burnt. Greens, blacks, greys, and yellows, on being mixed with a little of the gall of the ox, carp, or eel, especially of the last, acquire a lustre and vivacity not natural to them. You must take the galls of eels, and hang them on a nail to dry; and when you use any steep it in brandy, and mingle some of it with the colour already tempered with gum water wherein is a little sugar-candy. When you begin to paint, the colours must be placed on a small ivory pallet of the size of your hand, in the middle of which should be placed the white, well spread out, and nearer it the lighter, and further off those darker colours you are going to use.

Your vellum must be glued to a copper-plate, or a piece of thin board, exactly of the same size with the intended piece; in doing which, the fair side of the vellum should be moistened with a fine wet lichen, and a piece of white paper being put upon the back of it, it is to be applied to the plate or board, and stretching it upon it equally in all directions, the vellum, which ought to be every way a finger's-breadth larger than what you glue it to, in order to be doubled over and glued behind. When your piece is sketched out upon the vellum with a pencil, you must, with a little thin carmine, run over all the strokes that they may not be defaced in working; and this done, clean your vellum with crumb of bread. In laying on the colours, begin with sketching or drawing with large,  
3 R bold,

bold, but clear strokes; like those who paint in oil; your lights must at first be something brighter, and your shades not quite so dark as is required in finishing; because in stripping upon them you strengthen the colour, which, if too deep at first, would in finishing become too dark. Endeavour also to drown your colours into each other, that no line of separation may be seen between them: to this purpose, soften your strokes with the colours on each side of them, so that they may be blended and confounded with each other. There are several ways of stripping, and every painter has his manner: some do it with round points, others make them longish; others again hath fine strokes, crossing each other in all directions, till the whole appears as if stripped or wrought with points: this last method is the best, boldest, and soonest perfected: the artist should here accustom himself to be rich, mellow, and soft in his work; the points must seem in a manner lost in the ground they are wrought upon, and appear but just enough to shew that the piece is stripped. When the work seems finished, heightening it a little has a fine effect; that is, strengthening the lights with touches of a paler colour than at first, which must be softened away into the rest.

For laces, point, and the like, lay on first a mixture of blue, black, and white, as for linens; and then heighten the pattern, flowers or flourishes, with white only; then shade and finish with the first colour. When they are upon flesh, or any thing else which you would have seen through them, finish what is under them, as if you intended to lay nothing upon it, and then lay on the lace or point with pure white, and finish with the other mixture. In painting a fur, lay on a ground as for drapery, according to the colours of it, and then shade by the same rule; and having done, instead of stripping, draw fine strokes this way and that, according as the down of the fur you imitate lies: heighten the lights of a brown fur with ochre and white, and those of a light fur with white and a little blue.

There are several sorts of grounds for pictures and portraits: some are quite brown, with Spanish brown, umber, &c. with a little black and white; others are more yellow, being mixed with a good deal of ochre; others are upon the grey, with indigo; and others are blue or crimson.

To make a ground all of glory, first lay a bright mixture of a little ochre and white, adding more and more of the first, as you draw more and more towards the extremities of the intended picture; and when the ochre happens not to be dark enough (for you must go on darkening and darkening,) add gall-stone, then carmine, and at last Spanish brown. This ground you must lay in such a manner, that the different degrees of darkness may, as much as possible, insensibly increase and strengthen: the whole must then be stripped with the same colours.

For a day-sky, mingle some ultramarine with a good deal of white, and lay it on as smooth and uniform as possible with a large pencil and broad strokes, laying it on paler and paler as you descend towards the horizon, which must be made of vermilion, mine-de-plumb and

white, of the strength that finishes the sky, or rather a little weaker, artfully blending the blue and red, mingling at last gall-stone and a good deal of white; and all this must be so laid on that no separation must be seen between the colours. When there are to be clouds in the sky, you need lay on no blue where they are to be; but sketch them out, if they are reddish, with vermilion, gall-stone, and white, together with a little indigo; and if they are to be darker, a great deal must be used of this last, making the lights of the one and the other with masticot, vermilion, and white, according to the degree of strength you would give them, swelling out the whole with stripping; and if the sky be not sufficiently uniform, you must strip that likewise.

MINIM, in music, a note equal to two crotchets, or half a semibreve. See MUSIC.

MINIMUM, in the higher geometry, the least quantity attainable in a given case.

MINISTER, a person who preaches, performs religious worship in public, administers the sacraments, &c.

MINISTERS, in Scots law. See LAW, Tit. 5.

MINISTER of state, a person to whom a sovereign prince intrusts the administration of the government.

Foreign MINISTER, is a person sent into a foreign country, to manage the affairs of his province, or of the state to which he belongs. Of these there are two kinds; those of the first rank are ambassadors and envoys extraordinary, who represent the persons of their sovereigns. The ministers of the second rank are the ordinary residents. See EMBASSADOR.

MINIUM, or RED-LEAD. See CHEMISTRY, p. 84. and 136.

MINOR, in Scots law. See LAW, Tit. 7.

MINOR, in logic, the second proposition of a regular syllogism. See LOGIC.

MINORCA, an island in the Mediterranean, about twenty miles east of Majorca, thirty miles long, and twelve broad. It is subject to Great Britain, and only valued for its capacious harbour of Port Mahon.

MINOTAUR, in antiquity, a fabulous monster much talked of by the poets, feigned to be half man and half bull.

The minotaur was brought forth by Pasiphae, wife of Minos, king of Crete. It was shut up in the labyrinth of that island, and at last killed by Theseus.

Servius gives the explanation of this fable: he says that a secretary of king Minos, named Taurus, bull, having an intrigue with the queen Pasiphae, in the chamber of Dædalus, she was at length delivered of twins; one of whom resembled Minos, and the other Taurus. This occasioned the production to be reputed monstrous.

MINSTREL, an ancient term for a fiddler, or player on any other kind of musical instrument.

MINT, the place in which the king's money is coined. See COINAGE.

There were anciently mints in almost every county in England; but the only mint at present in the British dominions, is that in the Tower of London. The officers of the mint are, 1. The warden of the mint, who is chief; he oversees the other officers, and receives the bullion. 2. The master worker; who receives the bullion

bullion from the warden, causes it to be melted, delivers it to the moneyers, and when it is coined receives it again. 3. The comptroller, who is the overseer of all the inferior officers, and sees that all the money is made to the just assize. 4. The assay-master; who weighs the gold and silver, and sees that it is according to the standard. 5. The auditor; who takes the accounts. 6. The surveyor of the melting; who after the assay-master has made trial of the bullion, sees that it is cast out, and not altered after it is delivered to the melter. 7. The engraver; who engraves the stamps and dyes for the coinage of the money. 8. The clerk of the irons; who sees that the irons are clean and fit to work with. 9. The melter; who melts the bullion before it is coined. 10. The provost of the mint; who provides for, and oversees all the moneyers, 11. The blanchers; who anneal and cleanse the money. 12. The moneyers; some of whom forge the money, some shear it, lame round and mill it, and some stamp or coin it. 13. The porters; who keep the gate of the mint.

MINT, in botany, See MENTHA.

MINUARTIA, in botany, a genus of the triandria trigynia class. The calix consists of five leaves; it has no corolla; and the capsule has one cell and three valves. There are three species, all natives of Spain. MINUET, in music, a very graceful kind of dance, which consists of a couple, a high step, and a balance; it begins with a beat, and its motion is triple.

MINUTE, in geometry, the sixtieth part of a degree of a circle. See ASTRONOMY, GEOGRAPHY, GEOMETRY.

MINUTE of time, the sixtieth part of an hour.

MINUTE, in architecture, usually denotes the sixtieth, sometimes the thirtieth part of a module. See ARCHITECTURE.

MINUTE is also used for a short memoir, or sketch of a thing, taken in writing.

MIRABILIS, MARVEL OF PERU, in botany, a genus of the pentandria monogynia class. The corolla is funnel shaped; the calix is below the fruit; and the nectarium is globular, including the germen. There are three species, all natives of America.

Tournefort and Linnæus will have the root of this plant to be the jalap of the shops; but Houston declares, that jalap is the root of a species of convolvulus.

MIRACLE, is a work effected in a manner different from the common and regular method of providence, by the interposition either of God himself, or some intelligent agent superior to man.

MIRALETUS, in ichthyology. See RAJA.

MISCHNAH, or MISNAH, the code or collection of the civil law of the Jews. The Jews pretend, that when God gave the written law to Moses, he gave him also another not written, which was preserved by tradition among the doctors of the synagogue, till rabbi Judah, surnamed the Holy, seeing the danger they were in, through their dispersion, of departing from the traditions of their fathers, judged it proper to reduce them to writing.

The mishnah is divided in six parts: the first relates to the distinction of seeds in a field, to trees, fruits,

tythes, &c. The second regulates the manner of observing festivals: the third treats of women, and matrimonial cases: the fourth of losses in trade, &c.: the fifth is on obligations, sacrifices, &c.: and the sixth treats of the several sorts of purification.

MISDEMEANOUR, in law, signifies a heinous offence or fault, particularly in the execution of an office.

MISFEASANCE, in law-books, signifies a trespass.

MISLETOE, in botany. See VISCUM.

MISNOMER, in law, a misnaming, or mistaking a person's name. The Christian name of a person should always be perfect, but the law is not so strict and precise in regard to surnames, a small mistake in which will be dispensed with to make good a contract, and support the act of the party.

MISPRISION signifies, in general, some neglect or oversight; as where a person is privy to a treason or felony committed by another, and neglects to reveal it to the king or his council, or to a magistrate; but entirely conceals it: this is called misprision of those crimes. In cases of misprision of treason, the offender is to be imprisoned for life, and to forfeit his goods and chattels, together with the profits of his lands, &c. but in misprision of felony, the offender is only to be punished with fine and imprisonment, and to remain in prison till the fine is paid.

MISSAL, the Romish m.s. book, containing the several masses to be said on particular days.

MISSIL BIRD. See TURDUS.

MISSIONARIES, such ecclesiastics as are sent by any Christian church, into pagan or infidel countries, to convert the natives, and establish the Christian religion among them.

MISUSER, in law, signifies some abuse of any particular liberty or benefit.

MISY, in natural history, a species of the chalcantha, a fossil very common in the Turkish dominions, and sometimes found in the mines at Kremnitz in Hungary.

It is a considerably firm substance, of an irregular texture, not compact, much resembling some of our more gaudy marchasites, but wanting in their hardness and weight. It is of no determinate shape or size, but it is oftentimes found in small detached masses, which are usually broad, flat, and very rugged at the edges. As to its medical virtues, they are no other than those of the green vitriol.

MITCHELLA, in botany, a genus of the tetrandria monogynia class. The corolla consists of one petal; it has four stigmata; and the berry is bifid, containing four seeds. There is but one species, a native of Carolina.

MITE, a small coin formerly current, equal to about one third part of a farthing.

MITE, in zoology. See ACARUS.

MITELLA, in botany, a genus of the decandria digynia class. The calix consists of five segments, the corolla of five pinnatifid petals inserted into the calix, and the capsule of two equal valves. There are two species, none of them natives of Britain.

MITRALES VALVULÆ. See ANATOMY, p. 279.

MITRE, a sacerdotal ornament worn on the head by bishops and certain abbots on solemn occasions; being a  
fort.

fort of cap, pointed, and cleft at top. The high priest among the Jews wore a mitre or bonnet on his head. The inferior priests among the Jews had likewise their mitres, but in what respect they differed from that of the high-priest is uncertain. Some contend that the ancient bishops wore mitres, but this is by no means certain.

**MITRIFOLA**, in botany. See **OPHIORRHIZA**.

**MITRAU**, the capital of the duchy of Courland, in Poland: situated in E. long. 24°, N. lat. 56° 40'.

**MITTIMUS**, as generally used, hath two significations. 1. It signifies a writ for removing and transferring of records from one court to another. 2. It signifies a precept, or command in writing under the hand and seal of a justice of the peace, directed to the gaoler or keeper of some prison, for the receiving and safe keeping of an offender charged with any crime until he be delivered by due course of law.

**MIXT**, or **MIXT BODY**, in chemistry, that which is compounded of different elements or principles. See **CHEMISTRY**.

**MIXTURE**, a compound, or assemblage of several different bodies in the same mass. See **CHEMISTRY**.

**MIZEN**, in the sea-language, is a particular mast or sail. The mizen-mast stands in the sternmost part of the ship. In some great ships there are two of these; when that next the main-mast is called the main-mizen, and that next the poop the bonaventure-mizen.

**MNIUM**, in botany, a genus of the cryptogamia musci class. The anth. is operculated; and the capitulum of the female is naked, and dusty. There are 18 species, 7 of which are natives of Britain.

*Perpetual* **MOBILE**, or **MOVEMENT**. See **MOVEMENT**.

**MOCO**, or **МОСНО**, a great city and port-town of Arabia Felix, situated near the straits of Babelmandel, at the entrance of the Red Sea: E. long 45°, N. lat. 13°.

**MODBURY**, a market-town of Devonshire, 32 miles south-west of Exeter.

**MODE**, in metaphysics, denotes the manner of a thing's existence. See **METAPHYSICS**, p. 179.

**MODE**, in music, is defined to be a particular manner of constituting the octave; or, it is the melodious constitution of the octave, as it consists of seven essential sounds, besides the key or fundamental.

A mode, then, is the particular order of the concinnous degrees of an octave; the fundamental note whereof may be called the key, as it signifies that principal note which regulates the rest.

**MODEL**, in a general sense, an original pattern, proposed for any one to copy or imitate.

This word is particularly used, in building, for an artificial pattern made in wood, stone, plaster, or other matter, with all its parts and proportions, in order for the better conducting and executing some great work, and to give an idea of the effect it will have in large. In all great buildings, it is much the surest way to make a model in relieve, and not to trust to a bare design or draught.

**MODENA**, a duchy of Italy, bounded by Mantua on the north, by Romania on the east, by Tuscany and Lucca on the south, and by Parma and the territory of Genoa on the west.

**MOBENA**, the capital of the duchy of that name, situated in 11° 20' E. long, and 44° 45' N. lat.

**MODERATOR**, in the schools, the person who presides at a dispute, or in a public assembly: thus the president of the annual assembly of the church of Scotland, is styled moderator.

**MODERN**, in a general sense, something new, or of our time, in opposition to what is antique or ancient.

**MODICA**, a town of Sicily, in the province of Noto, twenty-five miles south of Syracuse.

**MODIFICATION**, in philosophy, that which modifies a thing, or gives it this or that manner of being.

Quantity and quality are accidents which modify all bodies.

*Decree of* **MODIFICATION**, in Scots law, a decree ascertaining the extent of a minister's stipend, without proportioning it among the persons liable in payment. See **LAW**, Tit. v. 13.

**MODILLIONS**, in architecture, ornaments in the cornice of the Ionic, Corinthian, and Composite columns. See **ARCHITECTURE**.

**MODIUS**, in antiquity, a kind of dry measure, in use among the Romans, for several sorts of grain.

**MODULATION**, in music, the art of keeping in, or changing the mode or key.

**MODULE**, in architecture, a certain measure or greatness, taken at pleasure, for regulating the proportions of columns, and the symmetry or disposition of the whole building. Architects generally chuse the semi-diameter of the bottom of the column for their module, and this they subdivide into parts or minutes. See **ARCHITECTURE**.

**MOHERINGIA**, in botany, a genus of the octandria digynia class. The calix has 4 leaves, and the corolla 4 petals, and the capsule consists of one cell and 4 valves. There is but one species, a native of Switzerland.

**MOFFAT**, a village in the shire of Annandale, thirty-six miles south west of Edinburgh; famous for its mineral wells, one of which is used for bathing, and the water of the other is taken inwardly. These waters are of great service in grippings of the guts, colics, and pains in the stomach. Those who are troubled with obstructions, rheumatic pains, and aches, find great relief both from bathing and drinking; nor is this water a less sovereign remedy in scorbutic cases, and the king's evil. These wells, in the opinion of Dr Plummer, professor of medicine in the university of Edinburgh, owe their virtues to a sulphureous principle.

**MOGULS**, or **MONGULS**, hords or tribes of vagrant Tartars, on the north of India, from whom the moguls or sovereigns of India, as well as of the Usbec-Tartars, are descended.

**MOHAIR**, in commerce, the hair of a kind of goat, frequent about Angoura, in Turkey; the inhabitants of which city are all employed in the manufacture of cambets, made of this hair.

**MOHAWK COUNTRY**, a part of North America, inhabited by one of the five nations of the Iroquois, situated between the province of New York and the lake Ontario or Frontignac.

**MOHILA**,

- MOHILA**, one of the Comora-islands in the Indian ocean, situated between Madagascar and the continent of Africa: E. long.  $43^{\circ} 30'$ , S. lat.  $12^{\circ}$ .
- MOIDORE**, a Portuguese gold coin, value 11. 7s. Sterling.
- MOIETY**, the half of any thing.
- MOLA**, in geography, a town of Italy, seven miles east of the city of Barri, in the kingdom of Naples.
- MOLA**, in ichthyology. See **TETRODON**.
- MOLARES**, or **DENTES MOLARES**, in anatomy, the large teeth called in English grinders. See **ANATOMY**, p. 165.
- MOLDAVIA**, a province of European Turkey, separated from Poland by the river Neister.
- MOLE**, in zoology. See **TALPA**.
- MOLE CRICKET**. See **GRYLLUS**.
- MOLE**, in midwifery, a mass of fleshy matter, of a spherical figure, generated in the uterus, or womb, and sometimes mistaken for a child. See **MIDWIFERY**.
- MOLE**, in geography, a river in Surry, so called from its running, for part of its course, under ground.
- MOLE**, is also a massive work of large stones laid in the sea by means of cofferdams; extending before a port, either to defend the harbour from the impetuosity of the waves, or to prevent the passage of ships without leave.
- ACTION OF MOLESTATION**, in Scots law. See **LAW**, Tit. xxx. 19.
- MOLLUGO**, in botany, a genus of the triandria trigynia class. The calix consists of five leaves; the corolla is wanting; and the capsule has three cells and three valves. There are five species, none of them natives of Britain.
- MOLLOSSES**, in commerce, the thick fluid matter remaining after the sugar is made, resembling syrup.
- In Holland molosses are much used in the manufacture of tobacco, and by the poor people for fugar. A brandy is also distilled from them, but it is said to be unwholesome.
- MOLOSSUS**, in Greek and Latin poetry, a foot composed of three long syllables, as *delectant*.
- MOLUCCA-ISLANDS**, five islands in the Indian ocean, the largest of which is scarce thirty miles round; they are called Bacchan, Machian, Motyr, Ternate, and Tydor; they produce sago, oranges, lemons, and some other fruits; but what is peculiar to these islands, is their producing cloves. They are subject to the Dutch, and are situated in  $125^{\circ}$  of east longitude, and between  $50'$  south, and  $2^{\circ}$  north latitude.
- MOLUCCELLA**, in botany, a genus of the didynamia gymnosperma class. The calix is bell-shaped, and larger than the corolla. There are three species, none of them natives of Britain.
- MOLWITZ**, a town of Silesia in the kingdom of Bohemia; E. long.  $16^{\circ} 45'$ , N. lat.  $50^{\circ} 26'$ .
- MOLYBDIA**, in natural history, the name of a genus of crystals, of a cubic form, or composed of six sides, at right angles, like a dye.
- MOMBABA**, or **MONBASA**, an island and city on the east coast of Africa, opposite to the country of Mombaza, in Zanguebar: E. long.  $48^{\circ}$ , N. lat.  $4^{\circ}$ .
- MOMENT**, in the doctrine of time, an instant, or the most minute and indivisible part of duration.
- MOMENTUM**, in mechanics, signifies the same with impetus, or the quantity of motion in a moving body;
- which is always equal to the quantity of matter multiplied into the velocity; or, which is the same thing, it may be considered as a rectangle under the quantity of matter and velocity.
- MOMORDICA**, in botany, a genus of the monœcia syngenesia class. The calix of the male and female consists of five segments; the corolla of the male has six segments; and the filaments are three. The corolla of the female consists of five segments; and it has three styli. There are eight species, none of them natives of Britain.
- MONA**, an island in the Baltic, south-west of the island of Zealand, subject to Denmark: E. long.  $12^{\circ} 30'$ , N. lat.  $55^{\circ} 20'$ .
- MONADELPHIA**, in botany. See **BOTANY**, p. 635.
- MONAGHAN**, a county of Ireland, in the province of Ulster, bounded by Tyrone, on the north; by Armagh, on the east; by Caven and Louth, on the south; and by the county of Fermanagh, on the west.
- MONANDRIA**, in botany. See **BOTANY**, p. 635.
- MONARCHY**, a government in which the supreme power is vested in a single person. See **GOVERNMENT**.
- MONARDA**, in botany, a genus of the diandria monogynia class. The corolla is unequal, the superior lip involving a linear filament. It has four seeds. There are five species, none of them natives of Britain.
- MONASTERY**, a convent, or house built for the reception and entertainment of monks, mendicant friars, or nuns, whether it be an abbey, priory, &c.
- Monasteries are governed by different rules, according to the different regulations prescribed by their founders. The first regular and perfect monasteries were founded by St. Pachomius, in Egypt: but St. Basil is generally considered as the great father and patriarch of the Eastern monks; since in the fourth century he prescribed rules for the government of the monasteries, to which the Anachorets and Coenobites, and the other ancient fathers of the deserts, submitted. In like manner St. Benedict was styled the patriarch of the Western monks. He appeared in Italy towards the latter end of the fifth century, and published his rule, which was universally received throughout the west. St. Augustin being sent into England by St. Gregory the pope, in the year 596, to convert the English, he at the same time introduced the monastic state into this kingdom; which made such progress here, that within the space of two hundred years, there were thirty kings and queens who preferred the religious habit to their crowns, and founded stately monasteries, where they ended their days in solitude and retirement.
- MONASTIC**, something belonging to monks. See **MONK**.
- MONCON**, a town of Spain, in the province of Arragon, fifty miles north-east of Saragossa.
- MONDAY**, the second day of the week, so called as being anciently sacred to the moon, *q. d. moon-day*.
- MONEMUGI**, a country in the south of Africa, situated between Angola and Zanguebar.
- MONEY**, a piece of matter, commonly metal, to which public authority has affixed a certain value and weight to serve as a medium in commerce.

*Of artificial or material money.*

I. FROM the infancy of the world, at least as far back as our accounts of the transactions of mankind reach, we find they had adopted the precious metals, that is, silver and gold, as the common measure of value, and as the adequate equivalent for every thing alienable.

The metals are admirably adapted for this purpose: They are perfectly homogeneous: When pure, their masses, or bulks, are exactly in proportion to their weights: No physical difference can be found between two pounds of gold, or silver, let them be the production of the mines of Europe, Asia, Africa, or America: They are perfectly malleable, fusible, and suffer the most exact division which human art is capable to give them: They are capable of being mixed with one another, as well as with metals of a baser, that is, of a less homogeneous nature, such as copper: By this mixture they spread themselves uniformly through the whole mass of the composed lump, so that every atom of it becomes proportionally possessed of a share of this noble mixture; by which means the subdivision of the precious metals is rendered very extensive.

Their physical qualities are invariable; they lose nothing by keeping; they are solid and durable; and though their parts are separated by friction, like every other thing, yet still they are of the number of those which suffer least by it.

If money, therefore, can be made of any thing, that is, if the proportional value of things vendible can be measured by any thing material, it may be measured by the metals.

II. The two metals being pitched upon as the most proper substances for realizing the ideal scale of money, those who undertake the operation of adjusting a standard must constantly keep in their eye the nature and qualities of a scale, as well as the principles upon which it is formed.

The unit of the scale must constantly be the same, although realized in the metals, or the whole operation fails in the most essential part. This realizing the unit is like adjusting a pair of compasses to a geometrical scale, where the smallest deviation from the exact opening once given must occasion an incorrect measure. The metals, therefore, are to money what a pair of compasses is to a geometrical scale.

This operation of adjusting the metals to the money of account implies an exact and determinate proportion of both metals to the money unit, realized in all the species and denominations of coin, adjusted to that standard.

The smallest particle of either metal added to, or taken away from any coin, which represent certain determinate parts of the scale, overturns the whole system of material money. And if, notwithstanding such variation, these coins continue to bear the same denominations as before, this will as effectually destroy their usefulness in measuring the value of things, as it would overturn the usefulness of a pair of compasses, to suffer the opening to vary, after it is adjusted to the scale representing feet, toises, miles, or leagues, by which the distances up the plan are to be measured.

III. Debasing the standard is a good term; because it

conveys a clear and distinct idea. It is diminishing the weight of the pure metal contained in that denomination by which a nation reckons, and which we have called the money-unit. Raising the standard requires no farther definition, being the direct contrary.

IV. Altering the standard (that is, raising or debasing the value of the money-unit) is like altering the national measures or weights. This is best discovered by comparing the thing altered with things of the same nature which have suffered no alteration. Thus if the foot of measure was altered at once over all England, by adding to it, or taking from it, any proportional part of its standard length, the alteration would be best discovered, by comparing the new foot with that of Paris, or of any other country, which had suffered no alteration. Just so, if the pound sterling, which is the English unit, shall be found any how changed, and if the variation it has met with be difficult to ascertain, because of a complication of circumstances, the best way to discover it, will be to compare the former and the present value of it with the money of other nations which has suffered no variation. This the course of exchange will perform with the greatest exactness.

V. Artists pretend, that the precious metals, when absolutely pure from any mixture, are not of sufficient hardness to constitute a solid and lasting coin. They are found also in the mines mixed with other metals of a baser nature, and the bringing them to a state of perfect purity occasions an unnecessary expence. To avoid, therefore, the inconvenience of employing them in all their purity, people have adopted the expedient of mixing them with a *determinate proportion* of other metals, which hurts neither their fusibility, malleability, beauty, or lustre. This metal is called *alloy*; and, being considered only as a support to the principal metal, is accounted of no value in itself. So that eleven ounces of gold, when mixed with one ounce of silver, acquires, by that addition, no augmentation of value whatever.

This being the case, we shall, as much as possible, overlook the existence of alloy, in speaking of money, in order to render language less subject to ambiguity.

*Incapacities of the metals to perform the office of an invariable measure of value.*

I. WERE there but one species of such a substance as we have represented gold and silver to be; were there but one metal possessing the qualities of purity, divisibility, and durability; the inconveniences in the use of it for money would be fewer by far than they are found to be as matters stand.

Such a metal might then, by an unlimited division into parts exactly equal, be made to serve as a tolerably steady and universal measure. But the rivalry between the metals, and the perfect equality which is found between all their physical qualities, so far as regards purity and divisibility, render them so equally well adapted to serve as the common measure of value, that they are universally admitted to pass current as money.

What is the consequence of this? That the one measures the value of the other, as well as that of every other thing. Now the moment any measure begins to be measured

fared by another, whose proportion to it is not physically, perpetually, and invariably the same, all the usefulness of such a measure is lost. An example will make this plain.

A foot of measure is a determinate length. An English foot may be compared with the Paris foot, or with that of the Rhine; that is to say, it may be measured by them; and the proportion between their lengths may be expressed in numbers; which proportion will be the same perpetually. The measuring the one by the other will occasion no uncertainty; and we may speak of lengths by Paris feet, and be perfectly well understood by others who are used to measure by the English foot, or by the foot of the Rhine.

But suppose that a youth of twelve years old takes it into his head to measure from time to time, as he advances in age, by the length of his own foot, and that he divides this growing foot into inches and decimals: what can be learned from his account of measures! As he increases in years, his foot, inches, and subdivisions, will be gradually lengthening; and were every man to follow his example, and measure by his own foot, then the foot of a measure now established would totally cease to be of any utility.

This is just the case with the two metals. There is no determinate invariable proportion between their value; and the consequence of this is, that when they are both taken for measuring the value of other things, the things to be measured, like lengths to be measured by the young man's foot, without changing their relative proportion between themselves, change however with respect to the denominations of both their measures. An example will make this plain.

Let us suppose an ox to be worth three thousand pounds weight of wheat, and the one and the other to be worth an ounce of gold, and an ounce of gold to be worth exactly fifteen ounces of silver: If the case should happen, that the proportional value between gold and silver should come to be as 14 is to 1, would not the ox, and consequently the wheat, be estimated at less in silver, and more in gold, than formerly? Farther, would it be in the power of any state to prevent this variation, in the measure of the value of oxen and wheat, without putting into the unit of their money less silver and more gold than formerly.

If therefore any particular state should fix the standard of the unit of their money to one species of the metals, while in fact both the one and the other are actually employed in measuring value; does not such a state resemble the young man, who measures all by his growing foot? For if silver, for example, be retained as the standard, while it is gaining upon gold one fifteenth additional value; and if gold continue all the while to determine the value of things as well as silver, it is plain, that, to all intents and purposes, this silver-measure is lengthening daily, like the young man's foot, since the same weight of it must become every day equivalent to more and more of the same commodity; notwithstanding that we suppose the same proportion to subsist, without the least variation, between that commodity and every other species of things alienable.

Buying and selling are purely conventional, and no man

is obliged to give his merchandize at what may be supposed to be the proportion of its worth. The use, therefore of an universal measure, is, to mark, not only the relative value of the things to which it is applied as a measure, but to discover in an instant the proportion between the value of those, and of every other commodity valued by a determinate measure in all the countries of the world.

Were pounds sterling, livres, florins, piastres, &c. which are all money of account, invariable in their values, what a facility would it produce in all conversions, what an assistance to trade! But as they are all limited or fixed to coins, and consequently vary from time to time, this example shews the utility of the invariable measure which we have described.

There is another circumstance which incapacitates the metals from performing the office of money; the substance of which the coin is made, is a commodity, which rises and sinks in its value with respect to other commodities, according to the wants, competition, and caprices of mankind. The advantage, therefore, found in putting an intrinsic value into that substance which performs the function of money of account, is compensated by the instability of that intrinsic value; and the advantage obtained by the stability of paper, or symbolical money, is compensated by the defect it commonly has of not being at all times susceptible of realization into solid property or intrinsic value.

In order, therefore, to render material money more perfect, this quality of metal, that is, of a commodity, should be taken from it; and in order to render paper-money more perfect, it ought to be made to circulate upon metallic or land security.

II. There are several smaller inconveniences accompanying the use of the metals, which we shall here shortly enumerate:

1<sup>mo</sup>. No money made of gold or silver can circulate long, without losing of its weight, although it all along preserves the same denomination. This represents the contracting a pair of compasses which had been rightly adjusted to the scale.

2<sup>do</sup>. Another inconvenience proceeds from the fabrication of money. Supposing the faith of Princes who coin money to be inviolable, and the probity as well as capacity of those to whom they commit the inspection of the fineness of the metals to be sufficient, it is hardly possible for workmen to render every piece exactly of a proper weight, or to preserve the due proportion between pieces of different denominations; that is to say, to make every ten sixpences exactly of the same weight with every crown-piece and every five shillings struck in a coinage. In proportion to such inaccuracies, the parts of the scale become unequal.

3<sup>io</sup>. Another inconvenience, and far from being inconsiderable, flows from the expence requisite for the coining of money. This expence adds to its value as a manufacture, without adding any thing to its weight.

4<sup>to</sup>. The last inconvenience is, that by fixing the money of account entirely to the coin, without having any independent common measure to mark and control these deviations from mathematical exactness, which are either inseparable

inseparable from the metals themselves, or from the fabrication of them) the whole measure of value, and all the relative interests of debtors and creditors, become at the disposal not only of workmen in the mint, of Jews who deal in money, of clippers and washers of coin, but they are also entirely at the mercy of princes, who have the right of coinage, and who have frequently also the right of raising or debasing the standard of the coin, according as they find it most for their present and temporary interest.

*Methods which may be proposed for lessening the several inconveniences to which material money is liable.*

THE inconveniences from the variation in the relative value of the metals to one another, may in some measure be obviated by the following expedients.

1<sup>mo</sup>. By considering one only as the standard, and leaving the other to seek its own value, like any other commodity.

2<sup>do</sup>. By considering one only as the standard, and fixing the value of the other from time to time by authority, according as the market-price of the metals shall vary.

3<sup>io</sup>. By fixing the standard of the unit according to the mean proportion of the metals, attaching it to neither; regulating the coin accordingly; and upon every considerable variation in the proportion between them, either to make a new coinage, or to raise the denomination of one of the species, and lower it in the other, in order to preserve the unit exactly in the mean proportion between the gold and silver.

4<sup>to</sup>. To have two units, and two standards, one of gold, and one of silver, and to allow every body to stipulate in either.

5<sup>to</sup>. Or last of all, to oblige all debtors to pay one half in gold, and one half in the silver standard.

*Variations to which the value of the money-unit is exposed from every disorder in the coin.*

LET us suppose, at present, the only disorder to consist in a want of the due proportion between the gold and silver in the coin.

This proportion can only be established by the market-price of the metals; because an augmentation and rise in the demand for gold or silver has the effect of augmenting the value of the metal demanded. Let us suppose, that to day one pound of gold may buy fifteen pounds of silver; if to-morrow there be a high demand for silver, a competition among merchants to have silver for gold will ensue; they will contend who shall get the silver at the rate of fifteen pounds for one of gold: this will raise the price of it; and in proportion to their views of profit, some will accept of less than the fifteen pounds. This is plainly a raise in the silver, more properly than a fall in the gold; because it is the competition for the silver which has occasioned the variation in the former proportion between the metals.

Let us now suppose, that a state, having with great exactness examined the proportion of the metals in the market, and having determined the precise quantity of each for realizing or representing the money-unit, shall

execute a most exact coinage of gold and silver coin. As long as that proportion continues unvaried in the market, no inconvenience can result from that quarter, in making use of metals for money of account.

But let us suppose the proportion to change; that the silver, for example, shall rise in its value with regard to gold; will it not follow, from that moment, that the unit realized in the silver, will become of more value than the unit realized in the gold coin?

But as the law has ordered them to pass as equivalents for one another, and as debtors have always the option of paying in what legal coin they think fit, will they not all chuse to pay in gold, and will not then the silver coin be melted down or exported, in order to be sold as bullion, above the value it bears when it circulates in coin? Will not this paying in gold also really diminish the value of the money unit, since upon this variation every thing must sell for more gold than before, as we have already observed?

Consequently, merchandize which have not varied in their relative value to any other thing but to gold and silver, must be measured by the mean proportion of the metals; and the application of any other measure to them is altering the standard. If they are measured by the gold, the standard is debased; if by silver, it is raised.

If, to prevent the inconvenience of melting down the silver, the state shall give up affixing the value of their unit to both species at once, and shall fix it to one, leaving the other to seek its price as any other commodity; in that case, no doubt, the melting down of the coin will be prevented; but will ever this restore the value of the money-unit to its former standard? Would it, for example, in the foregoing supposition, raise the debased value of the money-unit in the gold coin, if that species were declared to be the standard? It would indeed render silver coin purely a merchandize, and, by allowing it to seek its value, would certainly prevent it from being melted down as before; because the pieces would rise conventionally in their denomination; or an agio, as it is called, would be taken in payments made in silver; but the gold would not, on that account, rise in its value, or begin to purchase any more merchandize than before. Were therefore the standard fixed to the gold, would not this be an arbitrary and a violent revolution in the value of the money-unit, and a debasement of the standard?

If, on the other hand, the state should fix the standard to the silver, which we suppose to have risen in its value, would that ever sink the advanced value which the silver coin had gained above the worth of the former standard unit? and would not this be a violent and an arbitrary revolution in the value of the money unit, and a raising of the standard?

The only expedient, therefore, is, in such a case, to fix the numerary unit to neither of the metals, but to contrive a way to make it fluctuate in a mean proportion between them; which is in effect the introduction of a pure ideal money of account.

The regulation of fixing the unit by the mean proportion, ought to take place at the instant the standard unit is affixed with exactness both to the gold and silver. If

it be introduced long after the market proportion between the metals has deviated from the proportion established in the coin; and if the new regulation is made to have a retrospect, with regard to the acquitting of permanent contracts entered into, while the value of the money-unit had attached itself to the lowest currency, in consequence of the principle above laid down; then the restoring the money-unit to that standard where it ought to have remained (to wit, to the mean proportion) is an injury to all debtors who have contracted since the time that the proportion of the metals began to vary.

This is clear from the former reasoning. The moment the market-price of the metals differs from that in the coin, every one who has payments to make, pays in that species which is the highest rated in the coin; consequently, he who lends, lends in that species. If after the contract, therefore, the unit is carried up to the mean proportion, this must be a loss to him who had borrowed.

From this we may perceive, why there is less inconvenience from the varying of the proportion of the metals, where the standard is fixed to one of them, than when it is fixed to both. In the first case, it is at least uncertain whether the *standard* or the *merchandise-species* is to rise; consequently it is uncertain whether the debtors or the creditors are to gain by a variation. If the *standard* species should rise, the creditors will gain; if the *merchandise-species* rises, the debtors will gain; but when the unit is attached to both species, then the creditors never can gain, let the metals vary as they will: if silver-rises, then debtors will pay in gold; if gold rises, debtors will pay in silver. But whether the unit be attached to one or to both species, the infallible consequence of a variation is, that one half of the difference is either gained or lost by debtors and creditors. The invariable unit is constantly the mean proportional between the two measures.

*How the variations in the intrinsic value of the unit of money must affect all the domestic interest of a Nation.*

If the changing the content of the bushel by which grain is measured, would affect the interest of those who are obliged to pay, or who are intitled to receive, a certain number of bushels of grain for the rent of lands; in the same manner must every variation in the value of the unit of account affect all persons who, in permanent contracts, are obliged to make payments, or who are intitled to receive sums of money stipulated in multiples or in fractions of that money unit.

Every variation, therefore, upon the intrinsic value of the money unit, has the effect of benefiting the class of creditors, at the expence of debtors, or *vice versa*.

This consequence is deduced from an obvious principle. Money is more or less valuable in proportion as it can purchase more or less of every kind of merchandise. Now without entering anew into the causes of the rise and fall of prices, it is agreed upon all hands, that whether an augmentation of the general mass of money in circulation has the effect of raising prices in general, or not, any augmentation of the quantity of the metals appointed to be put into the money-unit, must at least affect the value

of that money-unit, and make it purchase more of any commodity than before; that is to say, if 113 grains of fine gold, the present weight of a pound sterling in gold, can buy 113 pounds of flour; were the pound sterling raised to 114 grains of the same metal, it would buy 114 pounds of flour; consequently, were the pound sterling augmented by one grain of gold, every miller who paid a rent of ten pounds a year, would be obliged to sell 1140 pounds of his flour, in order to procure 10 pounds to pay his rent, in place of 1130 pounds of flour which he sold formerly to procure the same sum; consequently, by this innovation, the miller must lose yearly ten pounds of flour, which his master consequently must gain. From this example, it is plain, that every augmentation of metals put into the pound sterling, either of silver or gold, must imply an advantage to the whole class of creditors who are paid in pounds sterling, and consequently must be a proportional loss to all debtors who must pay by the same denomination.

*Of the disorder in the British coin, for so far as it occasions the melting down or the exporting of the specie.*

THE defects in the British coin are three.

1<sup>mo</sup>. The proportion between the gold and silver in it is found to be as 1 to  $15\frac{2}{3}$ , whereas the market price may be supposed to be nearly as 1 to  $14\frac{1}{2}$ .

2<sup>do</sup>. Great part of the current money is worn and light.

3<sup>io</sup>. From the second defect proceeds the third, to wit, that there are several currencies in circulation which pass for the same value, without being of the same weight.

4<sup>to</sup>. From all these defects results the last and greatest inconvenience, to wit, that some innovation must be made, in order to set matters on a right footing.

The English, besides the unit of their money which they call the pound sterling, have also the unit of their weight for weighing the precious metals.

This is called the pound troy, and consists of 12 ounces, every ounce of 20 penny-weight, and every penny-weight of 24 grains. The pound troy, therefore, consists of 240 penny-weight, and 5760 grains.

The fineness of the silver is reckoned by the number of ounces and penny-weights of the pure metals in the pound troy of the composed mass; or in other words, the pound troy, which contains 5760 grains of standard silver, contains 5328 grains of fine silver, and 432 grains of copper, called alloy.

Thus standard silver is 11 ounces 2 penny-weights of fine silver in the pound troy to 18 penny-weights copper, or 111 parts fine silver to 9 parts alloy.

Standard gold is 11 ounces fine to one ounce silver or copper employed for alloy, which together make the pound troy; consequently, the pound troy of standard gold, contains 5280 grains fine; and 480 grains alloy, which alloy is reckoned of no value.

This pound of standard silver is ordered, by statute of the 43<sup>d</sup> of Elizabeth, to be coined into 62 shillings, 20 of which make the pound sterling; consequently the 20 shillings contain 1718.7 grains of fine silver, and 1858.06 standard silver.

The pound troy of standard gold,  $\frac{11}{12}$  fine, is ordered

by an act of King Charles II. to be cut into  $44\frac{1}{2}$  guineas; that is to say, every guinea contains 129.43 grains of standard gold, and 118.644 of fine gold; and the pound sterling, which is  $\frac{2}{7}$  of the guinea, contains 112.994, which we may state at 113 grains of fine gold.

The coinage in England is entirely defrayed at the expence of the state. The mint price for the metals is the very same with the price of the coin. Whoever carries to the mint an ounce of standard silver, receives for it in silver coin 5s. 2d. or 62d: whoever carries an ounce of standard gold receives in gold coin 3l. 17s. 10d $\frac{1}{2}$ . the one and the other making exactly an ounce of the same fineness with the bullion. Coin, therefore, can have no value in the market above bullion; consequently, no loss can be incurred by those who melt it down.

When the guinea was first struck, the government (not inclining to fix the pound sterling to the gold coin of the nation) fixed the guinea at 20 shillings, (which was then below its proportion to the silver) leaving it to seek its own price above that value, according to the course of the market.

By this regulation no harm was done to the English silver standard; because the guinea, or 118.644 grains fine gold being worth more, at that time, than 20 shillings, or 1718.7 grains fine silver, no debtor would pay with gold at its standard value, and whatever it was received for above that price was purely conventional.

Accordingly guineas sought their own price until the year 1728, that they were fixed a-new, not below their value as at first, but at what was then reckoned their exact value, according to the proportion of the metals, to wit, at 21 shillings, and at this they were ordered to pass current in all payments.

This operation had the effect of making the gold a standard as well as the silver. Debtors then paid indifferently in gold as well as in silver, because both were supposed to be of the same intrinsic as well as current value; in which case no inconvenience could follow upon this regulation. But, in time, silver came to be more demanded; the making of plate began to prevail more than formerly, and the exportation of silver to the East Indies increasing yearly, made the demand for it greater, or perhaps brought its quantity to be proportionally less than before. This changed the proportion of the metals; and by slow degrees they have come from that of 1 to 15.2 (the proportion they were supposed to have when the guineas were fixed and made a lawful money at 21 shillings) to that of 14.5 the present *supposed* proportion.

The consequence of this has been, that the same guinea which was worth 1804.6 grains fine silver, at the time it was fixed at 21 shillings, is now worth no more than 1719.9 grains of fine silver according to the proportion of 14 $\frac{1}{2}$  to 1.

Consequently, debtors, who have always the option of the legal species in paying their debts, will pay pounds sterling no more in silver but in gold; and as the gold pounds they pay in, are not intrinsically worth the silver pounds they paid in formerly, according to the statute of Elizabeth, it follows that the pound sterling in silver is really no more the standard, since no body will pay at that rate, and since no body can be compelled to do it.

Besides this want of proportion between the metals, the silver coined before the reign of George I. is now become light by circulation; and the guineas coined by all the Princes since Charles II. pass by tale, though many of them are considerably diminished in their weight.

Let us now examine what profit the want of proportion and the want of weight in the coin can afford to the money-jobbers, in melting it down or exporting it.

Did every body consider coin only as the measure for reckoning value, without attending to its value as a metal, the deviations of gold and silver coin from perfect exactness either as to proportion or weight would occasion little inconvenience.

Great numbers indeed, in every modern society, consider coin in no other light, than that of money of account; and have great difficulty to comprehend what difference any one can find between a light shilling and a heavy one; or what inconvenience there can possibly result from a guinea's being some grains of fine gold too light to be worth 21 shillings standard weight. And did every one think in the same way, there would be no occasion for coin of the precious metals at all; leather, copper, iron, or paper, would keep the reckoning as well as gold and silver.

But although there be many who look no farther than at the stamp on the coin, there are others whose sole business it is to examine its intrinsic worth as a commodity, and to profit of every irregularity in the weight and proportion of metals.

By the very institution of coinage, it is implied, that every piece of the same metal, and same denomination with regard to the money-unit, shall pass current for the same value.

It is, therefore, the employment of money-jobbers, to examine, with a scrupulous exactness, the precise weight of every piece of coin which comes into their hands.

The first object of their attention, is, the price of the metals in the market: a jobber finds, at present, that with 14.5 pounds of fine silver bullion, he can buy one pound of fine gold bullion.

He therefore buys up with gold coin, all the new silver as fast as it is coined, of which he can get at the rate of 15.2 pounds for one in gold; these 15.2 pounds silver coin he melts down into bullion, and converts that back into gold bullion, giving at the rate of only 14.5 pounds for one.

By this operation he remains with the value of  $\frac{7}{10}$  of one pound weight of silver bullion clear profit upon the 15 $\frac{1}{2}$  pounds he bought; which  $\frac{7}{10}$  is really lost by the man who inadvertently coined silver at the mint, and gave it to the money-jobber for his gold. Thus the state loses the expence of the coinage, and the public the convenience of change for their guineas.

But here it may be asked, Why should the money-jobber melt down the silver coin? can he not buy gold with it as well without melting it down? He cannot; because when it is in coin, he cannot avail himself of its being new and weighty. Coin goes by tale, not by weight; therefore, were he to come to market with his new silver coin, gold bullion being sold at the mint price, we shall suppose, viz. at 3l. 17s. 10 $\frac{1}{2}$ d. sterling money

*per ounce*, he would be obliged to pay the price of what he bought with heavy money, which he can equally do with light.

He therefore melts down the new silver coin, and sells it for bullion, at so many pence an ounce, the price of which bullion is, in the English market, always above the price of silver at the mint, for the reasons now to be given.

When you sell standard silver bullion at the mint, you are paid in weighty money; that is, you receive for your bullion the very same weight in standard coin; the coinage costs nothing; but when you sell bullion in the market, you are paid in worn out silver, in gold, in bank notes, in short, in every species of lawful current money. Now all these payments have some defect: the silver you are paid with is worn and light; the gold you are paid with is over-rated, and perhaps also light; and the bank notes must have the same value with the specie with which the bank pays them; that is, with light silver or over-rated gold.

It is for these reasons, that silver bullion, which is bought by the mint at 5*s.* 2*d.* *per ounce* of heavy silver money, may be bought at market at 65 pence the ounce in light silver, over-rated gold, or bank notes, which is the same thing.

Farther, we have seen how the imposition of coinage has the effect of raising coin above the value of bullion, by adding a value to it which it had not as a metal.

Just so, when the unit is once affixed to certain determined quantities of both metals, if one of the metals should afterwards rise in value in the market, the coin made of that metal must lose a part of its value as coin, although it retains it as a metal. Consequently, as in the first case, it acquired an additional value by being coined, it must now acquire an additional value by being melted down. From this we may conclude, that when the standard is affixed to both the metals in the coin, and when the proportion of that value is not made to follow the price of the market, that species which rises in the market is melted down, and the bullion is sold for a price as much exceeding the mint price as the metal has risen in its value.

If, therefore, in England, the price of silver bullion is found to be at 65 pence the ounce, while at the mint it is rated at 62; this proves that silver has risen  $\frac{3}{8}$  above the proportion observed in the coin, and that all coin of standard weight may consequently be melted down with a profit of  $\frac{3}{8}$ . But as there are several other circumstances to be attended to, which regulate and influence the price of bullion, we shall here pass them in review, the better to discover the nature of this disorder in the English coin, and the advantages which money-jobbers may draw from it.

The price of bullion, like that of every other merchandise, is regulated by the value of the money it is paid with.

If bullion, therefore, sells in England for 65 pence an ounce, paid in silver coin, it must sell for 65 shillings the pound troy; that is to say, the shillings it is commonly paid with do not exceed the weight of  $\frac{1}{8}$  of a pound troy: for if the 65 shillings with which the pound

of bullion is paid weighed more than a pound troy, it would be a shorter and better way for him who wants bullion to melt down the shillings and make use of the metal, than to go to market with them in order to get less.

We may, therefore, be very certain, that no man will buy silver bullion at 65 pence an ounce, with any shilling which weighs above  $\frac{1}{8}$  of a pound troy.

We have gone upon the supposition that the ordinary price of bullion in the English market is 65 pence *per ounce*. This has been done upon the authority of some late writers on this subject: it is now proper to point out the causes which may make it deviate from that value.

I. It may vary, and certainly will vary, in the price, according as the currency is better or worse. When the expences of a war, or a wrong balance of trade, have carried off a great many heavy guineas, it is natural that bullion should rise; because then it will be paid for more commonly in light gold and silver; that is to say, with pounds sterling, below the value of 113 grains fine gold, the worth of the pound sterling in new guineas.

II. This wrong balance of trade, or a demand for bullion abroad, becoming very great, may occasion a scarcity of the metals in the market, as well as a scarcity of the coin; consequently, an advanced price must be given for it in proportion to the greatness and height of the demand. In this case, both the specie and the bullion must be bought with paper. But the rise in the price of bullion proceeds from the demand for the metals, and the competition between merchants to procure them, and not because the paper given as the price is at all of inferior value to the specie. The least discredit of this kind would not tend to diminish the value of the paper; it would annihilate it at once. Therefore, since the metals must be had, and that the paper cannot supply the want of them when they are to be exported, the price rises in proportion to the difficulties in finding metals elsewhere than in the English market.

III. A sudden call for bullion, for the making of plate. A goldsmith can well afford to give 67 pence for an ounce of silver, that is to say, he can afford to give one pound of gold for 14 pounds of silver, and perhaps for less, notwithstanding that what he gives be more than the ordinary proportion between the metals, because he indemnifies himself amply by the price of his workmanship: just as a tavern keeper will pay any price for a fine fish, because, like the goldsmith, he buys for other people.

IV. The mint price has as great an effect in bringing down the price of bullion, as exchange has in raising it. In countries where the metals in the coin are justly proportioned, where all the currencies are of legal weight, and where coinage is imposed, the operations of trade make the price of bullion constantly to fluctuate between the value of the coin and the mint price of the metals.

Now let us suppose that the current price of silver bullion in the market is 65 pence the ounce, paid in lawful money, no matter of what weight, or of what metal. Upon this the money jobber falls to work. All shillings which are above  $\frac{1}{8}$  of a pound troy, he throws into his melting

melting pot, and sells them as bullion, for 65*d.* per ounce; all those which are below that weight he carries to market, and buys bullion with them, at 65 pence per ounce.

What is the consequence of this?

That those who sell the bullion, finding the shillings which the money-jobber pays with perhaps not above  $\frac{1}{8}$  of a pound troy, they on their side raise the price of their bullion to 66 pence the ounce.

This makes new work for the money-jobber; for he must always gain. He now weighs all shillings as they come to hand; and as formerly he threw into his melting-pot those only which were worth more than  $\frac{1}{8}$  of a pound troy, he now throws in all that are in value above  $\frac{1}{8}$ . He then sells the melted shillings at 66 pence the ounce, and buys bullion with the light ones at the same price.

This is the consequence of ever permitting any species of coin to pass by the authority of the stamp, without controlling it at the same time by the weight: and this is the manner in which money-jobbers gain by the currency of light money.

It is no argument against this exposition of the matter to say, that silver bullion is seldom bought with silver coin; because the pence in new guineas are worth no more than the pence of shillings of 65 in the pound troy: that is to say, that 240 pence contained in  $\frac{2}{3}$  of a new guinea, and 240 pence contained in 28 shillings of 65 to the pound troy differ no more in the intrinsic value than 0.88 of a grain of fine silver upon the whole, which is a mere trifle.

Whenever, therefore, shillings come below the weight of  $\frac{1}{8}$  of a pound troy, then there is an advantage in changing them for new guineas: and when that is the case, the new guineas will be melted down, and profit will be found in selling them for bullion, upon the principles we have just been explaining.

We have already given a specimen of the domestic operations of the money-jobbers; but these are not the most prejudicial to national concerns. The jobbers may be supposed to be Englishmen; and in that case the profit they make remains at home: but whenever there is a call for bullion to pay the balance of trade, it is evident that this will be paid in silver coin, never in gold, if heavy silver can be got; and this again carries away the silver coin, and renders it at home so rare, that great inconveniences are found for want of the lesser denominations of it. The loss, however, here is confined to an inconvenience; because the balance of trade being a debt which must be paid, we do not consider the exportation of the silver for that purpose as any consequence of the disorder of the coin. But besides this exportation which is necessary, there are others which are arbitrary, and which are made only with a view to profit of the wrong proportion.

When the money jobbers find difficulty in carrying on the traffic we have described, in the English market, because of the competition among themselves, they carry the silver coin out of the country, and sell it abroad for gold, upon the same principles that the East India company send silver to China, in order to purchase gold.

It may be demanded, what hurt this trade can do to

England, since those who export silver bring back the same value in gold? Were this trade carried on by natives, there would be no loss; because they would bring home gold for the whole intrinsic value of the silver. But if we suppose foreigners sending over gold to be coined at the English mint, and changing that gold into English silver coin, and then carrying off this coin, it is plain that they must gain the difference, as well as the money jobbers. But it may be answered, that having given gold for silver at the rate of the mint, they have given value for what they have received. Very right; but so did Sir Hans Sloane, when he paid five guineas for an overgrown tod: he got value for his money; but it was value only to himself. Just so, whenever the English government shall be obliged to restore the proportion of the metals, (as they must do,) this operation will annihilate that imaginary value which they have hitherto set upon gold; which imagination is the only thing which renders the exchange of their silver against the foreign gold equal.

But it is farther objected, that foreigners cannot carry off the heavy silver; because there is none to carry off. Very true; but then they have carried off a great quantity already: or if the English Jews have been too sharp to allow such a profit to fall to strangers, (which may or may not have been the case,) then this disorder is an effectual stop to any more coinage of silver for circulation.

*Of the disorder in the British coin, so far as it affects the value of the pound sterling currency.*

FROM what has been said, it is evident, that there must be found in England two legal pounds sterling, of different values; the one worth 113 grains of fine gold, the other worth 1718.7 grains of fine silver. We call them different; because these two portions of the precious metals are of different values all the over Europe.

But besides these two different pounds sterling, which the change in the proportion of the metals have created, the other defects of the circulating coin produce similar effects. The guineas coined by all the Princes since K. Charles II. have been of the same standard weight and fineness, 44½ in a pound troy of standard gold  $\frac{1}{2}$  fine: these have been constantly wearing ever since they have been coined; and in proportion to their wearing they are of less value.

If, therefore, the new guineas are below the value of a pound sterling in silver, (standard weight, the old must be of less value still. Here then is another currency, that is, another pound sterling; or indeed, more properly speaking, there are as many different pounds sterling, as there are guineas of different weights. This is not all; the money jobbers having carried off all the weighty silver, that which is worn with use, and reduced even below the standard of gold, forms one currency more, and totally destroys all determinate proportion between the money unit and the currencies which are supposed to represent it.

It may be asked, how, at this rate, any silver has remained in England? It is answered, that the few weighty shillings which still remain in circulation, have marvelously escaped the hands of the money jobbers; and as for the rest, the rubbing and wearing of these pieces has

done

done what the state might have done; that is to say, it has reduced them to their due proportion with the lightest gold.

The disorder, therefore, of the English coin has rendered the standard of a pound sterling quite uncertain. To say that it is 1718.7 grains of fine silver, is quite ideal. Who are paid in such pounds? To say that it is 113 grains of pure gold, may also not be true; because there are many currencies worse than the new guineas.

What then is the consequence of all this disorder? What effect has it upon the current value of a pound sterling? And which way can the value of that be determined?

The operations of trade bring value to an equation, notwithstanding the greatest irregularities possible, and so in fact a pound sterling has acquired a determinate value over all the world by the means of foreign exchange. This is a kind of ideal scale for measuring the British coin, although it has not all the properties of that described above.

Exchange considers the pound sterling as a value determined according to the combination of the values of all the different currencies, in proportion as payments are made in the one or the other; and as debtors generally take care to pay in the worst species they can, it consequently follows, that the value of the pound sterling should fall to that of the lowest currency.

Were there a sufficient quantity of worn gold and silver to acquit all bills of exchange, the pound sterling would come down to the value of them; but if the new gold be also necessary for that purpose, the value of it must be proportionally greater.

All these combinations are liquidated and compensated with one another, by the operations of trade and exchange: and the pound sterling, which is so different in itself, becomes thereby, in the eyes of commerce, a determinate unit, subject however to variations, from which it never can be exempted.

Exchange, therefore, is one of the best measures for valuing a pound sterling, present currency. Here occurs a question:

Does the great quantity of paper money in England tend to diminish the value of the pound sterling?

We answer in the negative. *Paper money* is just as good as gold or silver money, and no better. The variation of the standard; we have already said, must influence the interests of debtors and creditors proportionally every where. From this it follows, that all augmentation of the value of the money unit in the specie must hurt the debtors in the paper money; and all diminutions, on the other hand, must hurt the creditors in the paper money as well as every where else. The payments, therefore, made in paper money, never can contribute to the regulation of the standard of the pound sterling; it is the specie received in liquidation of that paper money which alone can contribute to mark the value of the British unit; because it is affixed to nothing else.

From this we may draw a principle, "That in countries where the money unit is entirely affixed to the coin, the actual value of it is not according to the legal standard of that coin, but according to the mean proportion of the actual worth of those currencies in which debts are paid.

From this we see the reason why the exchange between England and all other trading towns in Europe has long appeared so unfavourable. People calculate the real par, upon the supposition that a pound sterling is worth 1718.7 grains troy of fine silver, when in fact the currency is not perhaps worth 1638, the value of a new guinea in silver, at the market proportion of 1 to 14.5; that is to say, the currency is but 95.3. *per cent* of the silver standard of the 43d of Elizabeth. No wonder then if the exchange be thought unfavourable.

From the principle we have just laid down, we may gather a confirmation of what we advanced concerning the cause of the advanced price of bullion in the English market.

When people buy bullion with current money at a determinate price, that operation, in conjunction with the course of exchange, ought naturally to mark the actual value of the pound sterling with great exactness.

If therefore the price of standard bullion in the English market, when no demand is found for the exportation of the metals, that is to say, when paper is found for paper upon exchange, and when merchants versed in these matters judge exchange (that is, remittances) to be at par, if then, silver bullion cannot be bought at a lower price than 65 pence the ounce, it is evident that this bullion might be bought with 65 pence in shillings, of which 65 might be coined out of the pound troy English standard silver; since 65 per ounce implies 65 shillings for the 12 ounces or pound troy.

This plainly shows how standard silver bullion should sell for 65 pence the ounce, in a country where the ounce of standard silver in the coin is worth no more than 62; and were the market price of bullion to stand uniformly at 65 pence *per* ounce, that would shew the value of the pound sterling to be tolerably fixed. All the heavy silver coin is now carried off; because it was intrinsically worth more than the gold it passed for in currency. The silver therefore which remains is worn down to the market proportion of the metals, as has been said; that is to say, 20 shillings in silver currency are worth 113 grains of fine gold, at the proportion of 1 to 14.5 between gold and silver. Now,

as 1 is to 14.5, so is 113 to 1638.

so the 20 shillings current weigh but 1638 grains fine silver, instead of 1718.7, which they ought to do according to the standard.

Now let us speak of standard silver, since we are examining how far the English coin must be worn by use.

The pound troy contains 5760 grains. This, according to the standard, is coined into 62 shillings; consequently, every shilling ought to weigh 92.9 grains. Of such shillings it is impossible that ever standard bullion should sell at above 62 pence *per* ounce. If therefore such bullion sells for 65 pence, the shillings with which it is bought must weigh no more than 88.64 grains standard silver; that is, they must lose 4.29 grains, and are reduced to  $\frac{1}{3}$  of a pound troy.

But it is not necessary that bullion be bought with shillings; no stipulation of *price* is ever made farther, than at so many pence sterling *per* ounce. Does not this virtually determine the value of such currency with regard

gard to all the currencies in Europe? Did a Spaniard, a Frenchman, or a Dutchman, know the exact quantity of silver bullion which can be bought in the London market for a pound sterling, would he inform himself any farther as to the intrinsic value of that money-unit; would he not understand the value of it far better from that circumstance than by the course of any exchange, since exchange does not mark the intrinsic value of money, but only the value of that money transported from one place to another?

The price of bullion, therefore, when it is not influenced by extraordinary demand, (such as for the payment of a balance of trade, or for making an extraordinary provision of plate) but when it stands at what every body knows to be meant by the common market price, is a very tolerable measure of the value of the *actual* money standard in any country.

If it be therefore true, that a pound sterling cannot purchase above 1638 grains of fine silver bullion, it will require not a little logic to prove that it is really, or has been for these many years, worth any more; notwithstanding that the standard weight of it in England is regulated by the laws of the kingdom at 1718.7 grains of fine silver.

If to this valuation of the pound sterling drawn from the price of bullion, we add the other drawn from the course of exchange; and if by this we find, that when paper is found for paper upon exchanges, a pound sterling cannot purchase above 1638 grains of fine silver in any country in Europe; upon these two authorities we may very safely conclude (as to the matter of fact at least.) that the pound sterling is not worth more, either in London or in any other trading city; and if this be the case, it is just worth 20 shillings of 65 to the pound troy.

If therefore the mint were to coin shillings at that rate, and pay for silver bullion at the market price, that is, at the rate of 65 pence *per* ounce in those new coined shillings, they would be in proportion to the gold; silver would be carried to the mint equally with gold, and would be as little subject to be exported or melted down.

It may be inquired in this place, how far the coining the pound troy into 65 shillings is contrary to the laws of England?

The moment a state pronounces a certain quantity of gold to be worth a certain quantity of silver, and orders these respective quantities of each metal to be received as equivalents of each other, and as lawful money in payments, that moment gold is made a standard as much as silver. If therefore too small a quantity of gold be ordered or permitted to be considered as an equivalent for the unit, the silver standard is from that moment debased; or indeed, more properly speaking, all silver money is from that moment proscribed; for who, from that time, will ever pay in silver, when he can pay cheaper in gold? Gold, therefore, by such a law, is made the standard, and all declarations to the contrary are against the matter of fact.

Were the king, therefore, to coin silver at 65 shillings in the pound, it is demonstration, *that by such an act* he would commit no adulteration upon the standard: the adulteration is already committed. The standard has

descended to where it is, by slow degrees, and by the operation of political causes only; and nothing prevents it from falling lower, but the standard of the gold coin. Let guineas be now left to seek their value as they did formerly, and let light silver continue to go by tale, we shall see the guineas up at 30 shillings in 20 years time, as was the case in 1695.

It is as absurd to say that the standard of Queen Elizabeth has not been debased by enacting that the English unit shall be acquitted with 113 grains of fine gold, as it would be to affirm that it would not be debased from what it is at present by enacting that a pound of butter should every where be received in payment for a pound sterling; although the pound sterling should continue to consist of 3 ounces, 17 penny-weights, and 10 grains of standard silver, according to the statute of the 43d of Elizabeth. In that case most debtors would pay in butter, and silver would, as at present, acquire a conventional value as a metal, but would be looked upon no longer as a standard, or as money.

If therefore, by the law of England, a pound sterling must consist of 1718.7 grains troy of fine silver; by the law of England also, 113 grains of gold must be of the same value: but no law can establish that proportion; consequently, in which ever way a reformation be brought about, some law must be reversed; consequently, expediency, and not compliance with law, must be the motive in reforming the abuse.

From what has been said, it is not at all surprising that the pound sterling should in fact be reduced nearly to the value of the gold. Whether it ought to be kept at that value is another question. All that we here decide, is, that coining the pound troy into 65 shillings would restore the proportion of the metals, and render both species common in circulation. But restoring the weight and proportion of the coin is not the difficulty which prevents a reformation of the English coinage.

*Circumstances to be attended to in a new regulation of the British coin.*

To people who do not understand the nature of such operations, it may have an air of justice to support the unit at what is commonly believed to be the standard of Queen Elizabeth, to wit, at 1718.5 grains of fine silver.

The regulating the standard of both silver and gold to  $\frac{4}{7}$  fine, and the pound sterling to four ounces standard silver, as it stood during the reign of Queen Mary I. has also its advantages, as Mr Harris has observed. It makes the crown piece to weigh just one ounce, the shilling four penny weight, and the penny eight grains; consequently, were the new statute to bear, that the weight of the coin should regulate its currency upon certain occasions, the having the pieces adjusted to certain aliquot parts of weight would make weighing easy, and would accustom the common people to judge of the value of money by its weight, and not by the stamp.

In that case, there might be a conveniency in striking the gold coins of the same weight with the silver; because the proportion of their values would then constantly be the same with the proportion of the metals. The gold crowns would be worth at present, 3*l.* 12*s.* 6*d.* the half

half crowns 1*l.* 16*s.* 3*d.* the gold shillings 14*s.* and 6*d.* and the half 7*s.* and 3*d.* This was anciently the practice in the Spanish mints.

The interests within the state can be nowise perfectly protected but by permitting conversions of value from the old to the new standard, whatever it be, and by regulating the footing of such conversions by act of parliament, according to circumstances.

For this purpose, we shall examine those interests which will chiefly merit the attention of government, when they form a regulation for the future of acquitting permanent contracts already entered into. Such as may be contracted afterwards will naturally follow the new standard.

The landed interest is, no doubt, the most considerable in the nation. Let us therefore examine, in the first place, what regulations it may be proper to make, in order to do justice to this great class, with respect to the land-tax on one hand, and with respect to their lessees on the other.

The valuation of the lands of England was made many years ago, and reasonably ought to be supported at the real value of the pound sterling at that time, according to the principles already laid down. The general valuation, therefore, of the whole kingdom will rise according to this scheme. This will be considered as an injustice; and no doubt it would be so, if, for the future, the land tax be imposed as heretofore, without attending to this circumstance; but as that imposition is annual, as it is laid on by the landed interest itself, who compose the parliament, it is to be supposed that this great class will at least take care of their own interest.

Were the valuation of the lands to be stated according to the valuation of the pound sterling of 1718.7 grains of silver, which is commonly supposed to be the standard of Elizabeth, there would be no great injury done: this would raise the valuation only 5 per cent. and the land tax in proportion.

There is no class of inhabitants in all England so much at their ease, and so free from taxes, as the class of farmers. By living in the country, and by consuming the fruits of the earth without their suffering any alienation, they avoid the effect of many excises, which, by those who live in corporations, are felt upon many articles of their consumption, as well as on those which are immediately loaded with these impositions. For this reason it will not, perhaps, appear unreasonable, if the additional 5 per cent. on the land tax were thrown upon this class, and not upon the landlords.

With respect to leases, it may be observed, that we have gone upon the supposition that the pound sterling in the year 1728, was worth 1718.7 grains of fine silver, and 113 grains of fine gold.

There would be no injustice done the lessees of all the lands in the kingdom, were their rents to be fixed at the mean proportion of these values. We have observed how the pound sterling has been gradually diminishing in its worth from that time by the gradual rise of the silver. This mean proportion, therefore, will nearly answer to what the value of the pound sterling was in 1743; supposing the rise of the silver to have been uniform.

It may be farther alleged in favour of the landlords,

that the gradual debasement of the standard has been more prejudicial to their interest in letting their lands, than to the farmers in disposing of the fruits of them. Proprietors cannot so easily raise their rents upon new leases, as farmers can raise the prices of their grain, according to the debasement of the value of the currency.

The pound sterling, thus regulated at the mean proportion of its worth, as it stands at present, and as it stood in 1728, may be realized in 1678.6 grains of fine silver, and 115.76 grains fine gold; which is 2.4 per cent. above the value of the present currency. No injury, therefore, would be done to lessees, and no unreasonable gain would accrue to the landed interest, in appointing conversions of all land rents at 2½ per cent. above the value of the present currency.

Without a thorough knowledge of every circumstance relating to Great Britain, it is impossible to lay down any plan. It is sufficient, here, briefly to point out the principles upon which it must be regulated.

The next interest to be considered is that of the nation's creditors. The right regulation of their concerns will have a considerable influence in establishing public credit upon a solid basis, by making it appear to all the world, that no political operation upon the money of Great Britain can in any respect either benefit or prejudice the interest of those who lend their money upon the faith of the nation. The regulating also the interest of so great a body, will serve as a rule for all creditors who are in the same circumstances, and will, upon other accounts, be productive of greater advantages to the nation in time coming.

In 1749, a new regulation was made with the public creditors, when the interest of the whole redeemable national debt was reduced to 3 per cent. This circumstance infinitely facilitates the matter, with respect to this class, since, by this innovation of all former contracts, the whole national debt may be considered as contracted at or posterior to the 25th of December 1749.

Were the state, by any arbitrary operation upon money, (which every reformation must be,) to diminish the value of the pound sterling in which the parliament at that time bound the nation to acquit those capitals and the interest upon them, would not all Europe say, that the British parliament had defrauded their creditors? If therefore the operation proposed to be performed should have a contrary tendency, to wit, to augment the value of the pound sterling with which the parliament at that time bound the nation to acquit those capitals and interests, must not all Europe also agree, that the British parliament had defrauded the nation?

This convention with the ancient creditors of the state, who, in consequence of the debasement of the standard, might have justly claimed an indemnification for the loss upon their capitals, lent at a time when the pound sterling was at the value of the heavy silver, removes all cause of complaint from that quarter. There was in the year 1749, an innovation in all their contracts; and they are now to be considered as creditors only from the 25th of December of that year.

Let the value of the pound sterling be inquired into during one year preceding and one posterior to the trans-

ation of the month of December 1749. The great sums borrowed and paid back by the nation during that period will furnish data sufficient for that calculation. Let this value of the pound be specified in troy grains of fine silver and fine gold bullion, without mentioning any denomination of money according to the exact proportion of the metals at that time. And let this pound be called the *pound of national credit*.

This first operation being determined, let it be enacted, that the pound sterling, by which the state is to borrow for the future, and that in which the creditors are to be paid, shall be the exact mean proportion between the quantities of gold and silver above specified, according to the actual proportion of the metals at the time such payments shall be made; or that the sums shall be borrowed or acquitted, one half in gold and one half in silver, at the respective requisitions of the creditors or of the state, when borrowing. All debts contracted posterior to 1749, may be made liable to conversions.

The consequence of this regulation will be the insensible establishment of a bank money. Nothing would be more difficult to establish, by a positive revolution, than such an invariable measure; and nothing will be found so easy as to let it establish itself by its own advantages. This bank money will be liable to much fewer inconveniences than that of Amsterdam. There the persons transacting must be upon the spot; here, the sterling currency may, every quarter of a year, be adjusted by the exchequer to this invariable standard, for the benefit of all debtors and creditors, who incline to profit of the stability of this measure of value.

This scheme is liable to no inconvenience from the variation of the metals, let them be ever so frequent, or hard to be determined; because upon every occasion where there is the smallest doubt as to the actual proportion, the option competent to creditors to be paid half in silver and half in gold will remove.

Such a regulation will also have this good effect, that it will give the nation more just ideas of the nature of money, and consequently of the influence it ought to have upon prices.

If the value of the pound sterling shall be found to have been by accident less in December 1749, than it is at present; or if at present the currency be found below what has commonly been since 1749, in justice to the creditors, and to prevent all complaints, the nation may grant them the mean proportion of the value of the pound sterling from 1749 to 1760; or any other which may to parliament appear reasonable.

This regulation must appear equitable in the eyes of all Europe; and the strongest proof of it will be, that it will not produce the smallest effect prejudicial to the interest of the foreign creditors. The course of exchange with regard to them will stand precisely as before.

A Dutch, French, or German creditor, will receive the same value for his interest in the English stocks as heretofore. This must silence all clamours at home, being the most convincing proof, that the new regulation of the coin will have made no alteration upon the real value of any man's property, let him be debtor or creditor.

The interest of every other denomination of creditors, whose contracts are of a fixed date, may be regulated upon the same principles. But where debts are of an old standing, justice demands, that attention be had to the value of money at the time of contracting. Nothing but the stability of the English coin, when compared with that of other nations, can make such a proposal appear extraordinary. Nothing is better known in France than this stipulation added to obligations, *Argent au cours de ce jour*; that is to say, that the sum shall be repaid in coin of the same intrinsic value with what has been lent. Why should such a clause be thought reasonable for guarding people against arbitrary operations upon the numery value of the coin, and not be found just upon every occasion where the numery value of it is found to be changed, let the cause be what it will?

The next interest we shall examine is that of trade. When men have attained the age of twenty one, they have no more occasion for guardians. This may be applied to traders: they can party with their pen every inconvenience which may result to other people from the changes upon money, provided only the laws permit them to do themselves justice with respect to their engagements. This class demands no more than a right to convert all reciprocal obligations into denominations of coin of the same intrinsic value with those they have contracted in.

The next interest is that of buyers and sellers; that is, of manufacturers with regard to consumers, and of servants with respect to those who hire their personal service.

The interest of this class requires a most particular attention. They must, literally speaking, be put to school, and taught the first principles of their trade, which is buying and selling. They must learn to judge of price by the grains of silver and gold they receive: They are children of a mercantile mother, however warlike the father's disposition may be. If it be the interest of the state that their bodies be rendered robust and active, it is no less the interest of the state that their minds be instructed in the first principle of the trade they exercise.

For this purpose, tables of conversion from the old standard to the new must be made, and ordered to be put up in every market, in every shop. All duties, all excises, must be converted in the same manner. Uniformity must be made to appear every where. The smallest deviation from this will be a stumbling block to the multitude.

Not only the interest of the individuals of the class we are at present considering, demands the nation's care and attention in this particular; but the prosperity of trade, and the well-being of the nation, are also deeply interested in the execution.

The whole delicacy of the intricate combinations of commerce depends upon a just and equable vibration of prices, according as circumstances demand it. The more therefore the inauspicious classes are instructed in the principles which influence prices, the more easily will the machine move. A workman then learns to sink his price without regret, and can raise it without avidity. When principles are not understood, prices cannot gently fall,  
they

they must be pulled down; and merchants dare not suffer them to rise, for fear of abuse, even although the perfection of an infant manufacture should require it.

The last interest is that of the bank of England, which naturally must regulate that of every other.

Had this great company followed the example of other banks, and established a bank money of an invariable standard, as the measure of all their debts and credits, they would not have been liable to any inconvenience upon a variation of the standard.

The bank of England was projected about the year 1694, at a time when the current money of the nation was in the greatest disorder, and government in the greatest distress, both for money and for credit. Commerce was then at a very low ebb; and the only, or at least the most profitable trade of any, was jobbing in coin, and carrying backwards and forwards the precious metals from Holland to England. Merchants profited also greatly from the effects which the utter disorder of the coin produced upon the price of merchandize.

At such a juncture the resolution was taken to make a new coinage; and upon the prospect of this, a company was found, who, for an exclusive charter to hold a bank for 13 years, willingly lent the government upwards of a million sterling at 8 per cent. (in light money we suppose) with a prospect of being repaid both interest and capital in heavy. This was not all: part of the money lent was to be applied for the establishment of the bank; and no less than 4000 pounds a year was allowed to the company, above the full interest, for defraying the charge of management.

Under such circumstances the introduction of bank-money was very superfluous, and would have been very impolitic. That invention is calculated against the raising of the standard; but here the bank profited of that rise in its quality of creditor for the money lent, and took care not to commence debtor by circulating their paper, until the effect of the new regulation took place in 1695; that is, after the general recoinage of all the clipped silver.

From that time till now, the bank of England has been the basis of the nation's credit, and with great reason has been constantly under the most intimate protection of every minister.

The value of the pound sterling, as we have seen, has been declining ever since the year 1601, the standard being fixed to silver during all that century, while the gold was constantly rising. No sooner had the proportion taken another turn, and silver begun to rise, than the government of England threw the standard virtually upon the gold, by regulating the value of the guineas at the exact proportion of the market. By these operations, however, the bank has constantly been a gainer (in its quality of debtor) upon all the paper in circulation; and therefore has lost nothing by not having established a bank-money.

The interest of this great company being established upon the principles we have endeavoured to explain, it is very evident, that the government of England never will take any step in the reformation of the coin which in its consequences can prove hurtful to the bank. Such a step

would be contrary both to justice and to common sense. To make a regulation which, by raising the standard, will prove beneficial to the public creditors, to the prejudice of the bank (which we may call the public debtor) would be an operation upon public credit, like that of a person who is at great pains to support his house by props upon all sides, and who at the same time blows up the foundation of it with gun-powder.

We may therefore conclude, that with regard to the bank of England, as well as every other private banker, the notes which are constantly payable upon demand must be made liable to a conversion at the actual value of the pound sterling at the time of the new regulation.

That the bank will gain by this, is very certain; but the circulation of their notes is so swift that it would be absurd to allow to the then possessors of them that indemnification which naturally should be shared by all those through whose hands they have passed, in proportion to the debatement of the standard during the time of their respective possession.

Besides these considerations, which are in common to all states, the government of Great Britain has one peculiar to itself. The interest of the bank, and that of the creditors, are diametrically opposite: every thing which raises the standard, hurts the bank; every thing which can sink it, hurts the creditors: and upon the right management of the one and the other, depends the solidity of public credit. For these reasons, without the most certain prospect of conducting a restitution of the standard to the general advantage as well as approbation of the nation, no minister will probably ever undertake so dangerous an operation.

We shall now propose an expedient which may remove at least some of the inconveniences which would result from so extensive an undertaking as that of regulating the respective interests in Great Britain by a positive law, upon a change in the value of their money of account.

Suppose then, that, before any change is made in the coin, government should enter into a transaction with the public creditors, and ascertain a permanent value for the pound sterling for the future, specified in a determined proportion of the fine metals in common bullion, without any regard to money of account, or to any coin whatever.

This preliminary step being taken, let the intended alteration of the standard be proclaimed a certain time before it is to commence. Let the nature of the change be clearly explained, and let all such as are engaged in contracts which are dissolvable at will upon the prestations stipulated, be acquitted between the parties, or innovated as they shall think proper, with certification, that, posterior to a certain day, the stipulations formerly entered into shall be binding according to the denominations of the money of account in the new standard.

As to permanent contracts, which cannot at once be fulfilled and dissolved, such as leases, the parliament may either prescribe the methods and terms of conversion; or a liberty may be given to the parties to annul the contract, upon the debtor's refusing to perform his agreement according to the new standard. Contracts, on the other hand, might remain stable, with respect to credi-

tors who would be satisfied with payments made on the footing of the old standard. If the rise intended should not be very considerable, no great injustice can follow such a regulation.

Annuities are now thoroughly understood, and the value of them is brought to so nice a calculation, that nothing will be easier than to regulate these upon the footing of the value paid for them, or of the subject affected by them. If by the regulation land-rents are made to rise in denomination, the annuities charged upon them, ought to rise in proportion; if in intrinsic value, the annuity should remain as it was.

*Regulations which the principles of this inquiry point out as expedient to be made by a new statute for regulating the British coin.*

LET us now examine what regulations it may be proper to make by a new statute concerning the coin of Great Britain, in order to preserve always the same exact value of the pound sterling realized in gold and in silver, in spite of all the incapacities inherent in the metals to perform the functions of an invariable scale or measure of value.

1. The first point is to determine the exact number of grains of fine gold and fine silver which are to compose it, according to the then proportion of the metals in the London market.

2. To determine the proportion of these metals with the pound troy, and in regard that the standard of gold and silver is different, let the mint price of both metals be regulated according to the pound troy fine.

3. To fix the mint price within certain limits: that is to say, to leave to the King and Council, by proclamation, to carry the mint price of tullion up to the value of the coin, as is the present regulation, or to sink it to *per cent.* below that price, according as government shall incline to impose a duty upon coinage.

4. To order, that silver and gold coin shall be struck of such denominations as the King shall think fit to appoint; in which the proportion of the metals above determined shall be constantly observed through every denomination of the coin, until necessity shall make a new general coinage unavoidable.

5. To have the number of grains of the fine metal in every piece marked upon the exergue, or upon the legend of the coin, in place of some initial letters of titles, which not one person in a thousand can decypher; and to make the coin of as compact a form as possible, diminishing the surface of it as much as is consistent with beauty.

6. That it shall be lawful for all contracting parties to stipulate their payments either in gold or silver coin, or to leave the option of the species to one of the parties.

7. That where no particular stipulation is made, creditors shall have power to demand payment, half in one species, half in the other; and when the sum cannot fall equally into gold and silver coins, the fractions to be paid in silver.

8. That in buying and selling, when no particular species has been stipulated, and when no act in writing has

intervened, the option of the species shall be competent to the buyer.

9. That all sums paid or received by the King's receivers, or by bankers, shall be delivered by weight, if demanded.

10. That all money which shall be found under the legal weight, from whatever cause it may proceed, may be rejected in every payment whatsoever; or if offered in payment of a debt above a certain sum, may be taken according to its weight, at the then mint price, in the option of the creditor.

11. That no penalty shall be incurred by those who melt down or export the nation's coin; but that washing, clipping, or diminishing the weight of any part of it shall be deemed felony, as much as any other theft, if the person so degrading the coin shall afterwards make it circulate for lawful money.

To prevent the inconveniences proceeding from the variation in the proportion between the metals, it may be provided,

12. That upon every variation of proportion in the market price of the metals, the price of both shall be changed, according to the following rule.

Let the price of the pound troy fine gold in the coin be called G.

Let the price of ditto in the silver be called S.

Let the new proportion between the market price of the metals be called P.

Then state this formula:

$$\frac{G}{2P} + \frac{S}{2} = \text{to a pound troy fine silver, in sterling currency.}$$

$$\frac{S}{2} + P + \frac{G}{2} = \text{to a pound troy fine gold, in sterling currency.}$$

This will be a rule for the mint, to keep the price of the metals constantly at par with the price of the market; and coinage may be imposed, as has been described, by fixing the mint price of them at a certain rate below the value of the fine metals in the coin.

13. As long as the variation of the market price of the metals shall not carry the price of the rising metal so high as the advanced price of the coin above the bullion, no alteration need be made on the denomination of either species.

14. So soon as the variation of the market price of the metals shall give a value to the rising species, above the difference between the coin and the bullion; then the king shall alter the denominations of all the coin, silver and gold, adding to the coins of the rising metal exactly what is taken from those of the other. An example will make this plain.

Let us suppose that the coinage has been made according to the proportion of 14.5 to 1; that 20 shillings, or 4 crown-pieces, shall contain, in fine silver, 14.5 times as many grains as the guinea, or the gold pound, shall contain grains of fine gold. Let the new proportion of the metals be supposed to be 14 to 1. In that case, the 20 shillings, or the 4 crowns, will contain  $\frac{1}{5}$  more value than the guinea. Now since there is no question of making a new general coinage upon every variation, in order to adjust the proportion of the metals in the weight

of the coins, that proportion must be adjusted by changing their respective denominations according to this formula.

Let the 20 shillings, or 4 crowns, in coin, be called S. Let the guinea be called G. Let the difference between the old proportion and the new, which is  $\frac{1}{25}$ , be called P. Then say,

$$S - \frac{P}{2} = \text{a pound sterling, and } G + \frac{P}{2} = \text{a pound sterling.}$$

By this it appears that all the silver coin must be raised in its denomination  $\frac{1}{25}$ , and all the gold coin must be lowered in its denomination  $\frac{1}{25}$ ; yet still S+G will be equal to two pounds sterling, as before, whether they be considered according to the old, or according to the new denominations.

But it may be observed, that the imposition of coinage rendering the value of the coin greater than the value of the bullion, that circumstance gives a certain latitude in fixing the new denominations of the coin, so as to avoid minute fractions. For, providing the deviation from the exact proportion shall fall within the advanced price of the coin, no advantage can be taken by melting down one species preferably to another; since, in either case, the loss incurred by melting the coin must be greater than the profit made upon selling the bullion. The mint price of the metals, however, may be fixed exactly, that is, within the value of a farthing upon a pound of fine silver or gold. This is easily reckoned at the mint; although upon every piece in common circulation the fractions of farthings would be inconvenient.

15. That notwithstanding of the temporary variations made upon the denomination of the gold and silver coins, all contracts formally entered into, and all stipulations in pounds shillings and pence, may continue to be acquitted according to the old denominations of the coins, paying one half in gold, and one half in silver: unless in the case where a particular species has been stipulated; in which case, the sums must be paid according to the new regulation made upon the denomination of that species to the end that neither profit or loss may result to any of the parties.

16. That notwithstanding the alterations on the mint price of the metals, and in the denomination of the coins, no change shall be made upon the weight of the particular pieces of the latter, except in the case of a general recoinage of one denomination at least: that is to say, the mint must not coin new guineas, crowns, &c. of a different weight from those already in currency, although by so doing the fractions might be avoided. This would occasion confusion, and the remedy would cease to be of any use upon a new change in the proportion of the metals. But it may be found convenient, for removing the

small fractions in shillings and sixpences, to recoin such denominations all together, and to put them to their integer numbers, of twelve and of six pence, without changing in any respect their proportion of value to all other denominations of the coin: this will be no great expence, when the bulk of the silver coin is put into 5 shilling pieces.

By this method of changing the denominations of the coin, there never can result any alteration in the value of the pound sterling: and although fractions of value may now and then be introduced, in order to prevent the abuses to which the coin would otherwise be exposed by the artifice of those who melt it down, yet still the inconvenience of such fractions may be avoided in paying, according to the old denominations, in both species, by equal parts. This will also prove demonstratively, that no change is thereby made in the true value of the national unit of money.

17. That it be ordered, that shillings and sixpences shall only be current for twenty years, and all other coins, both gold and silver, for forty years, or more. For ascertaining which term, there may be marked, upon the exergue of the coin, the last year of their currency, in place of the date of their fabrication. This term elapsed, or the date effaced, that they shall have no more currency whatsoever; and when offered in payment, may be received as bullion at the actual price of the mint, or refused at the option of the creditor.

18. That no foreign coin shall have any legal currency, except as bullion at the mint price.

By these or the like regulations may be prevented, 1100. The melting or exporting of the coin in general. 210. The melting or exporting one species, in order to sell it as bullion, at an advanced price. 310. The profit in acquitting obligations preferably in one species to another. 410. The degradation of the standard, by the wearing of the coin, or by a change in the proportion between the metals. 510. The circulation of the coin below the legal weight. 910. The profit that other nations reap by paying their debts more cheaply to Great Britain than Great Britain can pay hers to them.

And the great advantage of it is, that it is an uniform plan, and may serve as a perpetual regulation, compatible with all kinds of denominations of coins, variations in the proportion of the metals, and with the imposition of a duty upon coinage; or with the preserving it free; and further, that it may in time be adopted by other nations, who will find the advantage of having their money of account preserved perpetually at the same value, with respect to the denominations of all foreign money of account established on the same principles.

# A T A B L E O F C O I N S , Shewing the Quantity of Fine Metal contained in them.

The number of grains of fine metal in every coin is fought for in the regulations of the mint of the country where it is coined, and is expressed in the grains in  
 ute in that mint. From that weight it is converted into thole of other countries, according to the following proportions :

3840 Troy grains, 4676.35 Paris grains, 5192.8 Holland aces or grains, and 4649.06 Colonia grains, are fupposed to be equal weights; and the coins in  
 the Table are converted according to thole proportions.

	Gold Coins.				Silver Coins.			
	Troy.	Paris.	Colonia.	Holland.	Troy.	Paris.	Colonia.	Holland.
<b>Table of Coins, reduced to Grains of fine Metal, according to the Troy, Paris, Colonia and Holland weights.</b>								
<b>English Coins.</b>								
1 A Guinea by feature	118.651	144.46	143.65	160.45	429.68	523.2	520.2	581.
2 A Crown by feature	—	—	—	—	85.935	104.65	104.	116.2
3 A Shilling by feature	—	—	—	—	1718.7	2093.	2080.8	2334.1
4 A Silver Pound sterling by feature 1601	—	—	—	—	—	—	—	—
5 A Gold Pound sterling by feature 1728	113.	137.61	126.8	152.8	1639.38	1996.4	1984.7	2216.
6 A Silver Pound sterling in currency = $\frac{66}{66}$ lb. Troy	—	—	—	—	1638.5	1995.3	1983.7	2215.7
7 A Silver Pound sterling at the proportion of gold to silver as 1 to 14 $\frac{1}{2}$	113.	137.61	136.8	152.8	1718.7	2093.	2080.8	2334.1
8 A Gold Pound sterling at the same proportion of 1 to 14 $\frac{1}{2}$	118.4	144.18	143.34	160.11	1678.6	2044.2	2032.2	2269.9
9 A Pound sterling at the mean proportion in gold and in silver	115.769	140.98	140.16	156.55	81.961	99.8	99.	110.82
10 A Shilling current = $\frac{64}{64}$ of a pound Troy	—	—	—	—	1804.6	2197.6	2184.8	2440.3
11 A Guinea in silver, or 21 Shillings standard weight	—	—	—	—	1720.4	2095.1	2082.8	2326.4
12 A Guinea at the proportion of 1 to 14 $\frac{1}{2}$ worth in silver	—	—	—	—	—	—	—	—
13 A Pound Troy, or 12 ounces English weight	5760.	7019.2	6973.5	7789.2	—	—	—	—
<b>French Coins.</b>								
1 A Louis d'or	113.27	137.94	137.13	153.17	409.94	499.22	496.3	554.3
2 A Crown of six livres	—	—	—	—	204.97	249.61	248.15	277.1
3 A Crown of three ditto	—	—	—	—	68.34	83.23	82.74	92.42
4 A Livre	—	—	—	—	1630.7	1996.9	1985.2	2217.4
5 A Louis d'or, or 24 livres in silver	—	—	—	—	3783.87	4608.	4581.1	5116.9
6 A Marc of Paris weight, fine gold or silver	3783.87	4668.	4581.1	5116.9	—	—	—	—
7 A Marc of gold coin effective weight, in fine	3358.3	4138.5	4114.3	4593.4	—	—	—	—
8 A Marc of silver coin effective weight, in fine	—	—	—	—	3402.3	4143.4	4119.2	4600.9
<b>German Coins.</b>								
1 A Carolin legal weight	115.45	140.6	139.78	156.12	—	—	—	—
2 A Ducat of the Empire ditto	52.8	64.37	64.	71.48	—	—	—	—
3 A Florin of Convention	—	—	—	—	179.73	218.87	217.6	243.
4 A Dollar of Convention	—	—	—	—	209.59	328.31	326.4	364.5
5 A Dollar of Exchange, the Carolin = 9 flor. 42 kreutzers	17.85	21.74	21.615	24.14	—	—	—	—
6 A Florin current = $\frac{1}{12}$ of a Carolin	10.54	12.84	12.77	14.26	—	—	—	—
7 A Carolin in silver, at the proportion of 1 to 14 $\frac{1}{2}$ .	—	—	—	—	1674.	2038.6	2026.8	2263.8
<b>Dutch Coins.</b>								
1 A Dutch Ducat	—	—	—	—	—	—	—	—
2 A Florin in silver	51.76	63.	62.67	70.	148.	180.3	179.2	200.21

- MONK**, a person who wholly dedicates himself to the service of religion, in some monastery, under the direction of some particular statutes and rules.
- The most probable account of the original of the monks is, that in the Decian persecution, in the middle of the III<sup>d</sup> century, many persons in Egypt, to avoid the fury of the storm, fled to the neighbouring deserts and mountains, where they not only found a safe retreat, but also more time and liberty to exercise themselves in acts of piety and divine contemplations; which sort of life became to agreeable, that when the persecution was over, they refused to return to their habitations again, chusing rather to continue in those cottages and cells, which they had made for themselves in the wilderness. From that time to the reign of Constantine, monachism was confined to the hermits or anachorets, who lived in private cells in the wilderness; but when Pachomius had erected monasteries, other countries presently followed the example.
- MONKEY**, in zoology. See **SIMIA**.
- MONMOUTH**, the capital of Monmouthshire, situated on the river Wye, twenty-five miles north of Bristol.
- MONOCHORD**, a musical instrument, composed of one string, used to try the variety and proportion of sounds.
- MONOCULUS**, in zoology, a genus of the order of aptera. The feet are fitted for swimming; the body is covered with a crustaceous skin; and the eyes are very near each other. There are nine species.
- MONODON**, in ichthyology, a genus of fishes belonging to the order of bete. It has a long wreathed tooth in the upper jaw, which perforates the upper-lip, and has the appearance of a horn; from this circumstance it has got the name of the unicorn-fish. This fish is of the whale kind, and often grows to 25 feet in length, though the general size is from 16 to 20.
- MONODY**, in ancient poetry, a mournful kind of song, sung by a person all alone, to give vent to his grief.
- MONOECIA**, in botany. See **BOTANY**, p. 635.
- MONOGAMY**, the state or condition of those who have only been once married, and are restrained to a single wife.
- MONOGRAM**, a character or cypher, composed of one, two, or more letters, interwoven; being a kind of abbreviation of a name, anciently used as a seal, badge, arms, &c.
- MONOLOGUE**, in poetry, a dramatic scene, in which a person appears alone on the stage, and speaks to himself.
- MONOMOTOPA**, a country of Africa, bounded by Monemugi on the north, and by Castraria on the east, south, and west.
- MONOPETALOUS**, in botany, a term applied to flowers that have only one petal, or flower-leaf.
- MONOPOLI**, a town in the kingdom of Naples, situated on the gulph of Venice: E. long. 18°, and N. lat. 40° 5'.
- MONOPOLY**, one or more persons making themselves the sole masters of the whole of a commodity, manufacture and the like, in order to make private advantage of it, by selling it again at a very advanced price.
- MONOPYRENEOUS**, in botany, such fruit as contains only one seed, or kernel.
- MONOSTICH**, an epigram that consists of only one single verse.
- MONOSYLLABLE**, in grammar, a word that consists of only one syllable, and is composed of either one or more letters pronounced at the same time.
- MONOTONY**, an uniformity of sound, or a fault in pronunciation, when a long series of words are delivered in one unvaried tone.
- MONOTROPA**, in botany, a genus of the decandria monogynia class. It has no calix; the petals are ten; and it has five capsules. There are two species, one of which, viz. the hypophitys, or bird's nest smelling like the roots of the primrose, is a native of Britain.
- MONS**, the capital of the province of Hainalt, in the Austrian Netherlands: situated twenty-six miles south-west of Brussels: east long. 3° 33', and south lat. 50° 34'.
- MONSIEUR**, a title of civility used by the French, in speaking to, or of their equals, or those that are but a little below them, synonymous with **SIR** in English.
- MONSOON**, in physiology, a species of trade-wind, in the East-Indies, which for six months blows constantly the same way, and the contrary way the other six months. See **PNEUMATICS**, *Of Winds*.
- MONSTER**, in general, denotes any production that deviates from the species to which it belongs, whether with respect to the number or disposition of its parts; in which sense, a man with six fingers on each hand, or six toes on each foot, is a monster. But the term monster seems to be chiefly applied to such productions as deviate very much from the ordinary course of nature.
- MONTE SANCTO**, or **MOUNT-ATHOS**, a mountain of European Turkey, in the province of Macedon: E. long. 23°, and N. lat. 40° 12'.
- It is called Monte Sancto, or Holy Mountain, from twenty two monasteries situated upon it, in which are four thousand monks or friars, who never suffer a woman to come within sight of their convent.
- MONTFERRAT**, a duchy in Italy, bounded by the lordship of Verceil on the north, by the Alexandrin on the east, by the territory of Genoa on the south, and by the county of Asti on the west.
- MONTFORT**, the capital of the county of Montfort, in the circle of Swabia, in Germany: E. long. 9° 40', and N. lat. 47° 15'.
- MONTGOMERY**, the capital of Montgomeryshire, in Wales, situated on the river Severn, twenty miles south-west of Shrewsbury.
- MONTH**, the twelfth part of a year. See **ASTRONOMY**.
- MONTIA**, in botany, a genus of the triandria trigynia class. The calix consists of one leaf, and the corolla of one irregular petal; and the capsule has one cell and three valves. There is but one species, viz. the sentana, or water chickweed, a native of Britain.
- MONTIFRINGILLA**,

**MONTIFRINGILLA**, in zoology. See **FRINGILLA**.  
**MONTPELIER**, a city of France, in the province of Languedoc and county of Nismes, situated on the little river Lez, fifty miles north-east of Narbonne, and forty-five miles south-west of Avignon; a place famous for its delightful situation, and its healthy serene air.

**MONTREAL**, a city of Sicily, in the province of Mazara, situated near the sea, five miles east of Palermo.

**MONTREAL** is also a town of Canada, in North America, situated on the river of St Laurence, one hundred miles south of Quebec.

**MONTROSE**, a town of North Britain, in the shire of Angus, situated at the mouth of the river Esk, on the German ocean, forty-six miles north-east of Edinburgh.

Steel spaws are very numerous in the country about Montrose; besides these, there is a well near this town whose water is of a whitish colour, soft taste, and faintly discovering a mineral quality, and is of a different nature from the steel one. It is universally diuretic; and has been found useful in stranguries, stoppages of urine, scorbutic disorders, flatulencies, &c.

**MONTSERAT**, a mountain of Spain, in the province of Catalonia, twenty-one miles north-west of Barcelona,

where there is a monastery and chapel dedicated to the Virgin Mary, to which there is a great resort of pilgrims.

**MONTSERAT** is also one of the smallest of the Caribbee islands; it is situated about thirty miles south-west of Antigua.

**MONUMENT**, in architecture, a building destined to preserve the memory, &c. of the person who raised it, or for whom it was raised; such are a triumphal arch, a mausoleum, a pyramid, &c.

**MOOD**, or **MODE**. See **LOGIC** and **METAPHYSICS**.  
**MOOD**, or **MODE**, in grammar, the different manner of conjugating verbs. See **GRAMMAR**.

**MOON**, in astronomy. See **ASTRONOMY**, p. 440.

**MOON-WORT**, in botany. See **LUNARIA**.

**MOOR**, in country affairs, denotes an unlimited tract of land, usually over-run with heath.

**MOOR-BUZZARD**. See **FALCO**.

**MOOR-COCK**, or **GOR-COCK**. See **TETRAO**.

**MOOR-STONE**, a valuable stone, much used in the coarser works of the present builders; being truly a white granite, of a marbly texture.

**MOORING**, or **MOARING**, in the sea language, is the laying out the anchors of a ship in a place where she can ride secure.

**MORAL**, something belonging to manners, or the conduct of life. See—

## MORAL PHILOSOPHY, OR MORALS.

**MORAL PHILOSOPHY** is "The science of **MANNERS** or **DUTY**; which it traces from man's "nature and condition, and shews to terminate in his happiness." In other words, it is "The knowledge of "our **DUTY** and **FELICITY**;" or, "The art of being "virtuous and happy."

It is denominated an art, as it contains a system of rules for becoming virtuous and happy. Whoever practises these rules, attains an habitual power or facility of becoming virtuous and happy. It is likewise called a science, as it deduces those rules from the principles and connexions of our nature, and proves that the observance of them is productive of our happiness.

It is an art, and a science, of the highest dignity, importance, and use. Its object is man's duty, or his conduct in the several moral capacities and connexions which he sustains. Its office is to direct that conduct; to shew whence our obligations arise, and where they terminate. Its use, or end, is the attainment of happiness; and the means it employs are rules for the right conduct of our moral powers.

Moral Philosophy has this in common with Natural Philosophy, that it appeals to nature or fact; depends on observation; and builds its reasonings on plain uncontroverted experiments, or upon the fullest induction of particulars of which the subject will admit. We must observe, in both these sciences, how nature is affected, and what her conduct is in such and such circumstances. Or,

in other words, we must collect the appearances of nature in any given instance; trace these to some general principles, or laws of operation; and then apply these principles or laws to the explaining of other phenomena.

Therefore Moral Philosophy inquires, not how man might have been, but how he is, constituted: not into what principles or dispositions his actions may be artfully resolved; but from what principles and dispositions they actually flow: not what he may, by education, habit, or foreign influence, come to be, or do; but what, by his nature, or original constituent principles, he is formed to be and do. We discover the office, use, or destination of any work, whether natural or artificial, by observing its structure, the parts of which it consists, their connection or joint action. It is thus we understand the office and use of a watch, a plant, an eye, or hand. It is the same with a living creature, of the rational, or brute kind. Therefore, to determine the office, duty, or destination of man; or, in other words, what his business is, or what conduct he is obliged to pursue; we must inspect his constitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

### *Of Man and his connexions.*

**MAN** is born a weak, helpless, delicate creature; unprovided with food, cloathing, and whatever else is necessary for subsistence, or defence. And yet, exposed as the

the infant is to numberless wants and dangers, he is utterly incapable of supplying the former, or securing himself against the latter. But, though thus feeble and exposed, he finds immediate and sure resources in the affection and care of his parents, who refuse no labours, and forego no dangers, to nurse and rear up the tender babe. By these powerful instincts, as by some mighty chain, does nature link the parent to the child; and form the strongest moral connection on his part, before the child has the least apprehension of it. Hunger and thirst, with all the sensations that accompany or are connected with them, explain themselves by a language strongly expressive, and irresistibly moving. As the several senses bring in notices and informations of surrounding objects, we may perceive in the young spectator early signs of a growing wonder and admiration. Bright objects and striking sounds are beheld and heard with a sort of commotion and surprise. But without resting on any, he eagerly passes on from object to object, still pleased with whatever is most new. Thus the love of novelty is formed, and the passion of wonder kept awake. By degrees he comes acquainted with the most familiar objects, his parents, his brethren, and those of the family who are most conversant with him. He contracts a fondness for them; is uneasy when they are gone, and charmed to see them again. These feelings become the foundation of a moral attachment on his side; and by this reciprocal sympathy he forms the domestic alliance with his parents, brethren, and other members of the family. Hence he becomes interested in their concerns; and feels joy or grief, hope or fear, on their account, as well as his own. As his affections now point beyond himself to others, he is denominated a good or ill creature, as he stands well or ill affected to them. These then are the first links of the moral chain, the early rudiments or outlines of his character, his first rude essays towards agency, freedom, manhood.

When he begins to make excursions from the nursery, and extend his acquaintance abroad, he forms a little circle of companions, engages with them in play or in quest of adventures, and leads or is led by them as his genius is more or less aspiring. Though this is properly the season in which appetite and passion have the ascendant, yet his imagination and intellectual powers open apace: and as the various images of things pass before the mental eye, he forms a variety of tastes; relishes some things and dislikes others, as his parents, companions, and a thousand other circumstances, lead him to combine agreeable or disagreeable sets of ideas, or represent to him objects in alluring or odious lights.

As his views are enlarged, his active and social powers expand themselves in proportion; and the love of action, of imitation, and of praise, emulation, curiosity, docility, a passion for command, and fondness of change. His passions are quick, variable, and pliant to every impression; his attachments and disgusts quickly succeed each other. He compares things, distinguishes actions, judges of characters, and loves or hates them as they appear well or ill affected to himself or to those he holds dear. Mean while, he soon grows sensible of the consequences of his

own actions, as they attract applause, or bring contempt; he triumphs in the former, and is ashamed of the latter, wants to hide them, and blushes when they are discovered. By means of these powers, he becomes a fit subject of culture, the moral tie is drawn closer, he feels that he is accountable for his conduct to others as well as to himself, and thus is gradually ripening for society and action.

As man advances from childhood to youth, his passions as well as perceptions take a more extensive range. New senses of pleasure invite him to new pursuits; he grows sensible to the attractions of beauty, feels a peculiar sympathy with the sex, and forms a more tender kind of attachment than he has yet experienced. This becomes the cement of a new moral relation, and gives a softer turn to his passions and behaviour. In this turbulent period he enters more deeply into a relish of friendship, company, exercises, and diversions; the love of truth, of imitation and of design, grows upon him; and as his connections spread among his neighbours, fellow citizens, and countrymen, his thirst of praise, emulation, and social affections grow more intense and active. Mean while it is impossible for him to have lived thus long without having become sensible of those more august signatures of order, wisdom, and goodness, which are stamped on the visible creation; and of those strong suggestions within himself of a parent mind, the source of all intelligence and beauty, and the object as well as source of that activity and those aspirations which sometimes rouse his inmost frame and carry him out of himself to an all-mighty and all-governing Power: Hence arise those sentiments of reverence, and those affections of gratitude, resignation, and love, which link the soul with the Author of nature, and form that most sublime and godlike of all connections.

Man having now reached his prime, either new passions succeed, or the old set are wound up to an higher pitch. For, growing more sensible of his connection with the public, and that particular community to which he more immediately belongs; and taking withal a larger prospect of human life, and its various wants and enjoyments; he forms more intimate friendships, grasps at power, courts honour, lays down cooler plans of interest, and becomes more attentive to the concerns of society; he enters into family-connections, and indulges those charities which arise from thence. The reigning passions of this period powerfully prompt him to provide for the decays of life; and in it compassion and gratitude exert their influence in urging the man, now in full vigour, to requite the affection and care of his parents, by supplying their wants and alleviating their infirmities.

At length human life verges downwards; and old age creeps on apace, with its anxiety, love of ease, interestedness, fearfulness, foresight, and love of offspring. The experience of the aged is formed to direct, and their coolness to temper, the heat of youth: the former teaches them to look back on past follies; and the latter to look forward into the consequences of things, and provide against the worst. Thus every age has its peculiar genius and set of passions, corresponding to that period, and most conducive to the prosperity of the rest. And thus are the

the wants of one period supplied by the capacities of another, and the weaknesses of one age tally to the passions of another.

Besides these, there are other passions and affections of a less ambulatory nature; not peculiar to one period, but belonging to every age, and acting more or less in every breath throughout life: such are, self-love, benevolence, love of life, honour, shame, hope, fear, desire, aversion, joy, sorrow, anger, and the like. The two first are affections of a cooler strain; one pointing to the good of the individual, the other to that of the species: joy, and sorrow, hope and fear, seem to be only modifications, or different exertions of the same original affections of love and hatred, desire and aversion, arising from the different circumstances or position of the object desired or abhorred, as it is present or absent. From these likewise arise other secondary, or occasional passions, which depend, as to their existence and several degrees, upon the original affections being gratified or disappointed; as, anger, complacence, confidence, jealousy, love, hatred, dejection, exultation, contentment, disgust, which do not form leading passions, but rather hold of them.

By these simple, but powerful springs, whether periodical or fixed, the life of man, weak and indigent as he is, is preserved and secured; and the creature is prompted to a constant round of action, even to supply his own numerous and ever-returning wants, and to guard against the various dangers and evils to which he is obnoxious. By these links, men are connected with each other, formed into families, drawn into particular communities, and all united, as by a common league, into one system or body, whose members feel and sympathize one with another. By this admirable adjustment of the constitution of man to his state, and the gradual evolution of his powers, order is maintained, society upheld, and human life filled with that variety of passion and action, which at once enliven and diversify it.

This is a short sketch of the principal movements of the human mind. Yet these movements are not the whole of man: they impel to action, but do not direct it; they need a regulator to guide their motions, to measure and apply their forces. And accordingly they have one that naturally superintends and directs their action. We are conscious of a principle within us, which examines, compares, and weighs things; notes the differences, observes the forces, and foresees the consequences of affections and actions. By this power we look back on past times, and forward into futurity, gather experiences, estimate the real and comparative value of objects, lay out schemes, contrive means to execute them, and settle the whole order and œconomy of life. This power we commonly distinguish by the name of reason, or reflection; the business of which is, not to suggest any original notices or sensations, but to canvass, range, and make deductions from them.

We are intimately conscious of another principle within us, which approves of certain sentiments, passions, and actions, and disapproves of their contraries. In consequence of the decisions of this inward judge, we denominate some actions and principles of conduct *right, honest, good*; and others *wrong, dishonest, ill*. The former ex-

cite our esteem, moral complacence, and affection, immediately and originally of themselves, without regard to their consequences, and whether they affect our interest or not. The latter do as naturally and necessarily call forth our contempt, scorn, and aversion. That power, by which we perceive this difference in affections and actions, and feel a consequent relish or dislike, is commonly called conscience, or the moral sense. Whether such a power belongs to human nature or not, must be referred to every one's experience of what passes within himself.

These two powers of reason and conscience, are evidently principles different in nature and kind from the passions and affections. For the passions are mere force or power, blind impulses, acting violently and without choice, and ultimately tending each to their respective objects, without regard to the interest of the others, or of the whole system: Whereas the directing and judging powers distinguish and ascertain the different forces, mutual proportions, and relations, which the passions bear to each other and to the whole; recognize their several degrees of merit; and judge of the whole temper and conduct, as they respect either the individual or the species; and are capable of directing or restraining the blind impulses of passion in a due consistency one with the other, and a regular subordination to the whole system.

This is some account of the constituent principles of our nature, which, according to their different mixtures, degrees, and proportions, mould our character, and sway our conduct in life. In reviewing that large train of affections which fill up the different stages of human life, we perceive this obvious distinction among them; that some of them respect the good of the individual, and others carry us beyond ourselves to the good of the species, or kind. The former have therefore been called private, and the latter public affections. Of the first sort are love of life, of pleasure, of power, and the like. Of the last are compassion, gratitude, friendship, natural affection, and the like. Of the private passions, some respect merely the security and defence of the creature; such as resentment, and fear: whereas others aim at some positive advantage or good; as wealth, ease, fame. The former sort therefore, because of this difference of objects, may be termed defensive passions. These answer to our dangers, and prompt us to avoid them if we can, or boldly to encounter them when we cannot.

The other class of private passions, which pursue private positive good, may be called appetitive. However, we shall still retain the name of private, in contradistinction to the defensive passions. Man has a great variety of wants to supply, and is capable of many enjoyments, according to the several periods of his life, and the different situations in which he is placed. To these, therefore, a suitable train of private passions correspond, which engage him in the pursuit of whatever is necessary for his subsistence or welfare.

Our public or social affections are adapted to the several social connections and relations which we bear to others, by making us sensible of their dangers, and interesting us in their wants, and so prompting us to secure them against one, and supply the other.

This is the first step then to discover the duty and destination

stitution of man, the having analyzed the principles of which he is composed. It is necessary, in the next place, to consider in what order, proportion, and measure of those inward principles, virtue, or a sound moral temper and right conduct, consists; that we may discover whence moral obligations arise.

*Of Duty, or Moral Obligation.*

It is by the end or design of any power or movement, that we must direct its motions, and estimate the degree of force necessary to its just action. If it want the force requisite for the obtaining its end, we reckon it defective; if it has too much, so as to be carried beyond it, we say it is over-charged; and in either case it is imperfect, and ill contrived. If it has just enough to reach the scope, we esteem it right, and as it should be. Let us apply this reasoning to the passions.

The defence and security of the individual being the aim of the defensive passions, that security and defence must be the measure of their strength or indulgence. If they are so weak as to prove insufficient for that end, or if they carry us beyond it, *i. e.* raise unnecessary commotions, or continue longer than is needful, they are unfit to answer their original design, and therefore are in an unsound and unnatural state. The exercise of fear or of resentment has nothing desirable in it, nor can we give way to either without painful sensations. Without a certain degree of them, we are naked and exposed: with too high a proportion of them, we are miserable, and often injurious to others. Thus cowardice or timidity, which is the excess of fear, instead of saving us in danger, gives it too formidable an appearance, makes us incapable of attending to the best means of preservation, and disarms us of courage our natural armour. Fool-hardiness, which is the want of a due measure of fear, leads us heedlessly into danger, and lulls us into a pernicious security. Revenge, *i. e.* excessive resentment, by the violence of its commotion, robs us of that presence of mind which is often the best guard against injury, and inclines us to pursue the aggressor with more severity than self defence requires. Pusillanimity, or the want of a just indignation against wrong, leaves us quite unguarded, and tends to sink the mind into a passive enervated tameness. Therefore, "to keep the defensive passions duly proportioned to our dangers, is their natural pitch and tenor."

The private passions lead us to pursue some positive species of private good. That good, therefore, which is the object and end of each, must be the measure of their respective force, and direct their operation. If they are too weak or sluggish to engage us in the pursuit of their several objects, they are evidently deficient; but if they defeat their end by their impetuosity, then are they strained beyond the just tone of nature. Thus vanity, or an excessive passion for applause, betrays into such meanness and little arts of popularity, as makes us forfeit the honour we so anxiously court. On the other hand, a total indifference about the esteem of mankind, removes a strong guard and spur to virtue, and lays the mind open to the most abandoned prosecutions. Therefore, "to keep our private passions and desires proportioned to our

wants, is the just measure and pitch of this class of affections."

The defensive and private passions do all agree in general in their tendency or conduciveness to the interest or good of the individual. Therefore, when there is a collision of interests, as may sometimes happen, that aggregate of good or happiness, which is composed of the particular goods to which they respectively tend, must be the common standard by which their comparative degrees of strength are to be measured. That is to say, if any of them, in the degree in which they prevail, are incompatible with the greatest aggregate of good, or most extensive interest of the individual, then are they unequal and disproportionate. For, in judging of a particular system or constitution of powers, we call that the supreme or principal end, in which the aims of the several parts or powers coincide, and to which they are subordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that subordination or subserviency. Therefore, "to proportion our defensive and private passions in such measure to our dangers and wants, as best to secure the individual, and obtain the greatest aggregate of private good or happiness, is their just balance or comparative standard in case of competition."

In like manner, as the public or social affections point at the good of others, that good must be the measure of their force. When a particular social affection, as gratitude or friendship, which belongs to a particular social connection, *viz.* that of a benefactor or of a friend, is too feeble to make us act the grateful or friendly part; that affection, being insufficient to answer its end, is defective and unsound. If, on the other hand, a particular passion of this class counteract or defeat the interest it is designed to promote, by its violence or disproportion, then is that passion excessive and irregular. Thus natural affection, if it degenerates into a passionate fondness, not only hinders the parents from judging coolly of the interest of their offspring, but often leads them into a most partial and pernicious indulgence.

As every kind affection points at the good of its particular object, it is possible there may be sometimes a collision of interests or goods. Thus the regard due to a friend may interfere with that which we owe to a community. In such a competition of interests, it is evident, that the greatest is to be chosen; and that is the greatest interest, which contains the greatest sum or aggregate of public good, greatest in quantity as well as duration. This then is the common standard, by which the respective forces and subordinations of the social affections must be adjusted. Therefore we conclude, that this "class of affections are sound and regular, when they prompt us to pursue the interest of individuals in an entire consistency with the public good:" or, in other words, "when they are duly proportioned to the dangers and wants of others, and to the various relations in which we stand to individuals, or to society."

Thus we have found, by an induction of particulars, the natural pitch or tenor of the different orders of affection, considered apart by themselves. Now as the virtue or perfection of every creature lies in following its nature,

or acting suitably to the just proportion and harmony of its several powers; therefore, "the virtue of a creature endowed with such affections as man, must consist in observing or acting agreeably to their natural pitch and tenor."

But, as there are no independent affections in the fabric of the mind, no passion that stands by itself without some relation to the rest, we cannot pronounce of any one, considered apart, that it is either too strong or too weak. Its strength and just proportion must be measured, not only by its subserviency to its own immediate end, but by the respect it bears to the whole system of affection. Therefore, we say a passion is too strong, not only when it defeats its own end, but when it impairs the force of other passions, which are equally necessary to form a temper of mind suited to a certain œconomy or state; and too weak, not merely on account of its insufficiency to answer its end, but because it cannot sustain its part or office in the balance of the whole system. Thus the love of life may be too strong, when it takes from the regard due to one's country, and will not allow one bravely to encounter dangers, or even death, on its account. Again, the love of fame may be too weak, when it throws down the fences which render virtue more secure, or weakens the incentives which make it more active and public-spirited.

If it be asked, "How far may the affections towards private good or happiness be indulged?" one limit was before fixed for the particular indulgencies of each, *viz.* their subordination to the common aggregate of good to the private system. In these therefore, a due regard is always supposed to be had to health, reputation, fortune, the freedom of action, the unimpaired exercise of reason, the calm enjoyment of one's self, which are all private goods. Another limit now results from the balance of affection just named, *viz.* "The security and happiness of others;" or, to express it more generally, "a private affection may be safely indulged, when, by that indulgence, we do not violate the obligations which result from our higher relations, or public connections." A just respect therefore being had to these boundaries, which nature has fixed in the breast of every man, What should limit our pursuits of private happiness? Is nature sullen and penurious? Or does the God of nature envy the happiness of his offspring?

Whether there is ever a real collision of interests between the public and private system of affections, or the ends which each class has in view, will be afterwards considered; but where there is no collision, there is little or no danger of carrying either, but especially the public affection, to excess, provided both kinds are kept subordinate to a discreet and cool self love, and to a calm and universal benevolence; which principles stand as guards at the head of each system.

This then is the conduct of the passions, considered as particular and separate forces, carrying us out to their respective ends; and this is their balance or œconomy, considered as compound powers, or powers mutually related, acting in conjunction towards a common end, and consequently as forming a system or whole.

Now, whatever adjusts or maintains this balance,

whatever in the human constitution is formed for directing the passions, so as to keep them from defeating their own end or interfering with each other, must be a principle of a superior nature to them, and ought to direct their measures, and govern their proportions. But it was found, that reason or reflection is such a principle, which points out the tendency of our passions, weighs their influence upon private and public happiness, and shews the best means of attaining either. It having been likewise found, that there is another directing or controuling principle, which we call conscience, or the moral sense, which, by a native kind of authority, judges of affections and actions, pronouncing some just and good, and others unjust and ill; it follows, that the passions, which are mere impulses, or blind forces, are principles inferior and subordinate to this judging faculty. Therefore, if we would observe the mutual respects and the subordination which the different parts of the human constitution bear one to another, the passions ought to be subjected to the direction and authority of the leading or controuling principles.

We conclude therefore from this induction, that "the constitution or just œconomy of human nature consists in a regular subordination of the passions and affections to the authority of conscience, and the direction of reason."

That subordination is regular, when the proportion formerly mentioned is maintained; that is to say, "When the defensive passions are kept proportioned to our dangers; when the private passions are proportioned to our wants; and when the public affections are adapted to our public connections, and proportioned to the wants and dangers of others."

But the natural state, or the sound and vigorous constitution, of any creature, or the just œconomy of its powers, we call its health and perfection; and the acting agreeably to these, its virtue or goodness. Therefore, "the health and perfection of man must lie in the aforesaid supremacy of conscience and reason, and in the subordination of the passions to their authority and direction; and his virtue or goodness must consist in acting agreeably to that order or œconomy."

That such an œconomy of the mind, and such a conduct of its power and passions, will stand the test of reason, cannot admit of any dispute. For, upon a fair examination into the consequences of things, or the relations and aptitudes of means to ends, reason evidently demonstrates, and experience confirms it, that "to have our defensive passions duly proportioned to our dangers, is the surest way to avoid or get clear of them, and obtain the security we seek after."—"To proportion our private passions to our wants, is the best means to supply them;—and, to adapt our public affections to our social relations and the good of others; is the most effectual method of fulfilling one, and procuring the other." In this sense, therefore, virtue may be said to be a "conduct conformable to reason, as reason discovers an apparent aptitude in such an order and œconomy of powers and passions to answer the end for which they are naturally formed.

If the idea of moral obligation is to be deduced merely from this aptitude or connection between certain passions, or a certain order and balance of passions, and certain ends

ends obtained or to be obtained by them; then is reason or reflection, which perceives that aptitude or connection, the proper judge of moral obligation; and on this supposition it may be defined, "the connection between the affection and the end, or between the action and the motive:" for the end is the motive, or the final cause; and the affection is the action, or its immediate natural cause. A man, from mere self-love, may be induced to fulfil that obligation which is founded on the connection between the defensive passions and their ends, or the private passions and their ends; because, in that case, his own interest will prompt him to indulge them in the due proportion required. But if he has no affections which point beyond himself, no principle but self-love or some subtle modification of it, what shall interest him in the happiness of others, where there is no connection between it and his own? or what sense can he have of moral obligation to promote it? Upon this scheme therefore, without public or social affections there could be no motive, and consequently no moral obligation, to a beneficent disinterested conduct.

But if the mere connection between certain passions, or a certain order of passions, and certain ends, is what constitutes or gives us the idea of moral obligation; then why may not the oppositeness of any temper or conduct, nay, of any piece of machinery, to obtain its end, form an equally strict moral obligation? For the connection and aptitude are as strong and invariable in the latter instances as in the former. But as this is confounding the most obvious differences of things, we must trace the idea of moral obligation to another and a more natural source.

Let us appeal therefore to sense and experience, "how we stand affected to those different sets of passions in the just measure and balance of which we found a right temper to consist." For this is entirely a matter of experience, in which we must examine, as in any other natural inquiry, "what are the genuine feelings and operations of nature, and what affections or symptoms of them appear in the given instance."

The defensive passions, as anger and fear, give us rather pain than pleasure; yet we cannot help feeling them when provoked by injury or exposed to harm. We account the creature imperfect that wants them, because they are necessary to his defence. Nay, we should in some measure condemn ourselves, did we want the necessary degree of resentment and caution. But if our resentment exceeds the wrong received, or our caution the evil dreaded, we then blame ourselves for having overacted our part. Therefore, while we are in danger, to be totally destitute of them we reckon a blameable defect, and to feel them in a just, *i. e.* necessary measure, we approve, as suited to the nature and condition of such a creature as man. But, our security obtained, to continue to indulge them, we not only disapprove as hurtful, but condemn as unmanly, unbecoming, and mean-spirited: Nor will such a conduct afford any self-approving joy, when we coolly reflect upon it.

With regard to the private passions, such as love of life, pleasure, ease, and the like; as these aim at private good, and are necessary to the perfection and happiness

of the individual, we should reckon any creature defective, and even blameable, that was destitute of them. Thus, we condemn the man who imprudently ruins his fortune, impairs his health, or exposes his life; we not only pity him as an unfortunate creature, but feel a kind of moral indignation and contempt of him, for having made himself such. On the other hand, though a discreet self-regard does not attract our esteem and veneration, yet we approve of it in some degree, in an higher and different degree from what we would regard a well-contrived machine as necessary to constitute a finished creature, nay, to complete the virtuous character, and as exactly suited to our present indigent state. There are some passions respecting private good, towards which we feel higher degrees of approbation; as the love of knowledge, of action, of honour, and the like. We esteem them as marks of an ingenious mind, and cannot help thinking the character in which they are wanting remarkably stupid, and in some degree immoral.

With regard to the social affections, as compassion, natural affection, friendship, benevolence, and the like, we approve, admire, and love them in ourselves, and in all in whom we discover them, with an esteem and approbation, if not different in kind, yet surely far superior in degree to what we feel towards the other passions. These we reckon necessary, just, and excellently fitted to our structure and state; and the creature which wants them we call defective, ill-constituted, a kind of abortion. But the public affections we esteem as self-worthy, originally and eternally amiable.

But among the social affections, we make an obvious and constant distinction, *viz.* between those particular passions, which urge us with a sudden violence, and uneasy kind of sensation, to pursue the good of their respective objects, as pity, natural affection, and the like; and those calm dispassionate affections and desires which prompt us more steadily and uniformly to promote the happiness of others. The former we generally call *passions*; to distinguish them from the other sort, which go more commonly by the name of *affections*, or *calm desires*. The first kind we approve indeed, and delight in; but we feel still higher degrees of approbation and moral complacency towards the last, and towards all limitations of the particular instincts, by the principle of universal benevolence. The more objects the calm affections take in, and the worthier these are, their dignity rises in proportion, and with this our approbation keeps an exact pace. A character, on the other hand, which is quite divested of these public affections, which feels no love for the species, but, instead of it, entertains malice, rancour, and ill-will, we reckon totally immoral and unnatural.

Such then are the sentiments and dispositions we feel, when these several orders of affection pass before the mental eye.

Therefore, "that state in which we feel ourselves moved, in the manner above described, towards those affections and passions, as they come under the mind's review, and in which we are instantaneously and independently of our choice or volition, prompted to a correspondent conduct, we call a state of moral obligation." Let us suppose, for instance, a parent, a friend, a benefactor, reduced

duced to a condition of the utmost indigence and distress, and that it is in our power to give them immediate relief. To what conduct are we obliged? what duty does nature dictate and require in such a case? Attend, and nature will tell with a voice irresistibly audible and commanding to the human heart, "that immediate relief ought to be given." Again, let a friend, a neighbour, or even a stranger, have lodged a deposit in our hands, and after some time reclaim it; no sooner do these ideas of the confidence reposed in us, and of property not transferred but deposited, occur, than we immediately and unavoidably feel and recognize the obligation to restore it. In both these cases, we should condemn ourselves, if we acted otherwise, as having done, or omitted doing, what we ought not;—as having acted beneath the dignity of our nature,—contrary to our most intimate sense of right and wrong:—we should accuse ourselves as guilty of ingratitude, injustice, and inhumanity;—and be conscious of deserving the censure, and therefore dread the repentment, of all rational beings,—But in complying with the obligation, we feel joy and self-approbation,—are conscious of an inviolable harmony between our nature and duty,—and think ourselves entitled to the applause of every impartial spectator of our conduct.

To describe therefore what we cannot perhaps define, a state of moral obligation, is "that state in which a creature, endued with such senses, powers, and affections as man, would condemn himself, and think he deserved the condemnation of all others, should he refuse to fulfil it; but would approve himself, and expect the approbation of all others, upon complying with it."

And we call him a moral agent, who is in such a state, or is subject to moral obligation. Therefore as man's structure and connections often subject him to such a state of moral obligation, we conclude that he is a moral agent. But as man may sometimes act without knowing what he does, as in cases of frenzy or disease, or in many natural functions; or, knowing what he does, he may act without choice or affection, as in cases of necessity or compulsion; therefore, to denominate an action moral, *i. e.* approveable, or blameable, it must be done knowingly and willingly, or from affection and choice. A morally good action, then, is "to fulfil a moral obligation knowingly and willingly;" and a morally bad action, or an immoral action, is "to violate a moral obligation knowingly and willingly."

As not an action, but a series of actions constitute a character; as not an affection, but a series of affections constitute a temper; and as we denominate things by the gross, *à fortiori*, or by the qualities which chiefly prevail in them: "therefore we call that a morally good character, in which a series of morally good actions prevail; and that a morally good temper, in which a series of morally good affections have the ascendant." A bad character and bad temper are the reverse. But where the above mentioned order or proportion of passions is maintained, there a series of morally good affections and actions will prevail. Therefore, "to maintain that order and proportion, is to have a morally good temper and character." But a "morally good temper and cha-

acter is moral rectitude, integrity, virtue, or the completion of duty."

If it be asked, after all, "How we come by the idea of moral obligation or duty?" we may answer, that we come by it in the same way as by our other original and primary perceptions. We receive them all from nature, or the great Author of nature. For this idea of moral obligation is not a creature of the mind, or dependent on any previous act of volition; but arises on certain occasions, or when certain other ideas are presented to the mind, as necessarily, instantaneously, and unavoidably, as pain does upon too near an approach to the fire, or pleasure from the fruition of any good. It does not, for instance, depend on our choice, whether we shall feel the obligation to succour a distressed parent, or to restore a deposit intrusted to us when it is recalled. We cannot call this a compound idea made up of one or more simple ideas. We may indeed, nay, we must, have some ideas antecedent to it, *e. g.* that of a parent—in distress—of a child—able to relieve—of the relation of one to the other,—of a trust,—of right, &c. But none of these ideas constitute the perception of obligation. These indeed, by a law of our nature, are the occasion of suggesting it; but they are as totally different from it, as colours are from sounds. By sense or reflection we perceive the correlatives, our memory recalls the favours or deposit we received, the various circumstances of the case are matters of fact or experience; but some delicate inward organ or power, or call it what we please, does, by a certain instantaneous sympathy, antecedent to the cool deductions of reason, and independent of previous instruction, art, or volition, perceive the moral harmony, the living irresistible charm of moral obligation, which immediately interests the correspondent passions, and prompts us to fulfil its awful dictates.

We need not apprehend any danger from the quickness of its decisions; nor be frightened, because it looks like instinct, and has been called so. Would we approve one for deliberating long, or reasoning the matter much at leisure, whether he should relieve a distressed parent, feed a starving neighbour, or restore the trust committed to him? Should we not suspect the reasoner of knavery, or of very weak affections to virtue? We employ reason in examining the condition, relations, and other circumstances of the agent or patient, or of those with whom either of them are connected, or, in other words, the state of the case; and in complicated cases, where the circumstances are many, it may require no small attention to find the true state of the case: but when the relations of the agent or patient, and the circumstances of the actions, are obvious, or come out such after a fair trial, we should scarce approve him who demurs on the obligation to that conduct which the case suggests.

From what has been said it is evident, that it is not the pleasure or agreeable sensations which accompany the exercise of the several affections, nor those consequent to the actions, that constitute moral obligation, or excite in us the idea of it. That pleasure is posterior to the idea of obligation; and frequently we are obliged, and acknowledge ourselves under an obligation, to such affections

affections and actions as are attended with pain; as in the trials of virtue, where we are obliged to sacrifice private to public good, or a present pleasure to a future interest. We have pleasure in serving an aged parent, but it is neither the perception nor prospect of that pleasure which gives us the idea of obligation to that conduct.

*The FINAL Causes of our Moral Faculties of Perception and Affection.*

WE have now taken a general prospect of man, and of his moral powers and connections; and on these erected a scheme of duty, or moral obligation, which seems to be confirmed by experience, consonant to reason, and approved by his most inward and most sacred senses. It may be proper, in the next place, to take a more particular view of the final causes of those delicate springs by which he is impelled to action, and of those clogs by which he is restrained from it.—By this detail we shall be able to judge of their aptitude to answer their end, in a creature endued with his capacities, subject to his wants, exposed to his dangers, and susceptible of his enjoyments; and from thence, we shall be in condition to pronounce concerning the end of his whole structure, its harmony with his state, and consequently its subserviency to answer the great and benevolent intentions of its author.

The supreme being has seen fit to blend in the whole of things a prodigious variety of discordant and contrary principles, light and darkness, pleasure and pain, good and evil. There are multifarious natures, higher and lower, and many intermediate ones between the wide-distant extremes. These are differently situated, variously adjusted, and subjected to each other; and all of them subordinate to the order and perfection of the whole. We may suppose man placed as in a centre amidst those innumerable orders of beings; by his outward frame drawn to the material system, and by his inward connected with the intellectual or moral, and of course affected by the laws which govern both, or affected by that good and all that ill which result from those laws. In this infinite variety of relations with which he is surrounded, and of contingencies to which he is liable, he feels strong attractions to the good, and violent repulsions or aversions to the ill. But as good and ill are often blended, and wonderfully complicated one with the other; as they sometimes immediately produce and run up into each other, and at other times lie at great distances, yet, by means of intervening links, introduce one another; and as these effects are often brought about in consequence of hidden relations, and general laws, of the energy of which he is an incompetent judge; it is easy for him to mistake good for evil, and evil for good; and consequently he may be frequently attracted by such things as are destructive, or repel such as are salutary. Thus, by the tender and complicated frame of his body, he is subjected to a great variety of ills, to sickness, cold, heat, fatigue, and innumerable wants. Yet his knowledge is so narrow withal, and his reason so weak, that in many cases he cannot judge, in the way of investigation, or reasoning, of the connections of those effects with their respective causes, or of the various latent energies of natural things. He is therefore informed of this connection by the experience of certain senses, or organs of perception, which,

by a mechanical instantaneous motion, feel the good and the ill, receiving pleasure from one, and pain from the other. By these, without any reasoning, he is taught to attract or chuse what tends to his welfare, and to repel and avoid what tends to his ruin. Thus, by his senses of taste and smell, or by the pleasure he receives from certain kinds of food, he is admonished which agree with his constitution, and, by an opposite sense of pain, he is informed which sorts disagree, or are destructive of it; but is not by means of these instructed in the inward natures and constitutions of things.

Some of those senses are armed with strong degrees of uneasiness or pain, in order to urge him to seek after such objects as are suited to them. And these respect his more immediate and pressing wants; as the sense of hunger, thirst, cold, and the like; which by their painful importunities, compel him to provide food, drink, raiment, shelter. Those instincts by which we are thus prompted, with some kind of commotion or violence, to attract and pursue good, or to repel and avoid ill, we call appetites and passions. By our senses then we are informed of what is good or ill to the private system, or the individual; and by our private appetites and passions we are impelled to one, and restrained from the other.

In consequence of this machinery, and the great train of wants to which our nature subjects us, we are engaged in a continued series of occupations, which often require much application of thought, or great bodily labour, or both. The necessaries of life, food, cloaths, shelter, and the like, must be provided; conveniencies must be acquired to render life still more easy and comfortable. In order to obtain these, arts, industry, manufactures, and trade are necessary: and to secure to us the peaceable enjoyment of their fruits, civil government, policy, and laws must be contrived, and the various business of public life carried on. Thus while man is concerned and busied in making provision, or obtaining security for himself, he is by degrees engaged in connections with a family, friends, neighbours, a community, or a commonwealth. Hence arise new wants, new interests, new cares, and new employments. The passions of one man interfere with those of another. Interests are opposed. Competitions arise; contrary courses are taken. Disappointments happen, distinctions are made, and parties formed. This opens a vast scene of distraction and embarrassment, and introduces a mighty train of good and ill, both public and private. Yet amidst all this confusion and hurry, plans of action must be laid, consequences foreseen or guarded against, inconveniencies provided for; and frequently particular resolutions must be taken, and schemes executed, without reasoning or delay.

Now, what provision has the Author of our nature made for this necessitous condition? How has he fitted the actor, man, for playing his part in this perplexed and busy scene?

Our supreme Parent, watchful for the whole, has not left himself without a witness here neither, and hath made nothing imperfect, but all things are double one against another. He has not left man to be informed, only by the cool notices of reason, of the good or ill, the happiness or misery of his fellow-creatures. He has

made him sensible of their good and happiness, but especially of their ill and misery, by an immediate sympathy, or quick feeling of pleasure and of pain.

The latter we call pity or compassion. For the former, though every one who is not quite divested of humanity feels it in some degree, we have not got a name, unless we call it congratulation, or joyful sympathy, or that good humour which arises on seeing others pleased or happy. Both these feelings have been called, in general, the public or common sense, by which we feel for others, and are interested in their concerns as really, though perhaps less sensibly, than in our own.

When we see our fellow-creatures unhappy through the fault or injury of others, we feel resentment or indignation against the unjust causers of that misery. If we are conscious that it has happened through our fault or injurious conduct, we feel shame; and both these classes of senses and passions, regarding misery and wrong, are armed with such sharp sensations of pain, as not only prove a powerful guard and security to the species, or public system, against those ills it may, but serve also to lessen or remove those ills it does, suffer. Compassion draws us out of ourselves to bear a part of the misfortunes of others, powerfully solicits us in their favour, melts us at sight of their distress, and makes us in some degree unhappy till they are relieved from it. It is peculiarly well adapted to the condition of human life, because it is much more and oftener in our power to do mischief than good, and to prevent or lessen misery than to communicate positive happiness; and therefore it is an admirable restraint upon the more selfish passions, or those violent impulses that carry us to the hurt of others.

There are other particular instincts or passions, which interest us in the concerns of others, even while we are most busy about our own, and which are strongly attractive of good, and repulsive of ill to them. Such are natural affection, friendship, love, gratitude, desire of fame, love of society, of one's country. Now as the private appetites and passions were found to be armed with strong sensations of desire and uneasiness, to prompt man the more effectually to sustain labours, and encounter dangers, in pursuit of those goods that are necessary to the preservation and welfare of the individual, and to avoid those ills which tend to his destruction; in like manner it was necessary that this other class of desires and affections should be prompted with as quick sensations of pain, not only to counteract the strength of their antagonists, but to engage us in a virtuous activity for our relations, families, friends, neighbours, country. Indeed our sense of right and wrong will admonish us that it is our duty, and reason and experience farther assure us that it is both our interest and best security, to promote the happiness of others; but that sense, that reason, and that experience, would frequently prove but weak and ineffectual prompters to such a conduct, especially in cases of danger and hardship, and amidst all the importunities of nature, and that constant hurry in which the private passions involve us, without the aid of those particular kind affections, which mark out to us particular spheres of duty, and with an agreeable violence engage and fix us down to them.

It is evident therefore, that these two classes of affection, the private and public, are set one against the other, and designed to controul and limit each others influence, and thereby to produce a just balance in the whole. In general, the violent sensations of pain or uneasiness which accompany hunger, thirst, and the other private appetites, or too great fatigue of mind as well as of body, prevent the individual from running to great excesses in the exercise of the higher functions of the mind; as too intense thought in the search of truth, violent application to business of any kind, and different degrees of romantic heroism. On the other hand, the finer senses of perception, and those generous desires and affections which are connected with them, the love of action, of imitation, of truth, honour, public virtue, and the like, are wisely placed in the opposite scale, in order to prevent us from sinking into the dregs of the animal life, and debasing the dignity of man below the condition of brutes. So that by the mutual reaction of those opposite powers, the bad effects are prevented that would naturally result from their acting singly and apart; and the good effects are produced which each are severally formed to produce.

The same wholesome opposition appears likewise in the particular counterworkings of the private and public affections one against the other. Thus compassion is adapted to counterpoise the love of ease, of pleasure, and of life; and to disarm, or to set bounds to resentment: and resentment of injury done to ourselves or to our friends, prevents an effeminate compassion or consternation; and gives us a noble contempt of labour, pain, and death. Natural affection, friendship, love of one's country, nay, zeal for any particular virtue, are frequently more than a match for the whole train of selfish passions. On the other hand, without that intimate over-ruling passion of self-love, and those private desires which are connected with it, the social and tender instincts of the human heart would degenerate into the wildest dotage, the most torturing anxiety, and downright frenzy.

But not only are the different orders or classes of affection checks one upon another, but passions of the same classes are mutual clogs. Thus, how many are withheld from the violent outrages of resentment by fear? and how easily is fear controuled in its turn, while mighty wrongs awaken a mighty resentment? The private passions often interfere, and therefore moderate the violence of each other; and a calm self-love is placed at their head to direct, influence, and controul their particular attractions and repulsions. The public affections likewise restrain one the other; and all of them are put under the controul of a calm dispassionate benevolence, which ought in like manner to direct and limit their particular motions.—Thus most part, if not all the passions have a twofold aspect, and serve a twofold end. In one view they may be considered as powers, impelling mankind to a certain course, with a force proportioned to the apprehended moment of the good they aim at. In another view they appear as weights balancing the action of the powers, and controuling the violence of their impulses. By means of these powers and weights a natural poise is settled in the human breast by its all-wise Author,

by which the creature is kept tolerably steady and regular in his course, amidst that variety of stages through which he must pass.

But this is not all the provision which God has made for the hurry and perplexity of the scene in which man is destined to act. — Amidst those infinite attractions and repulsions towards private and public good and ill, mankind either cannot often foresee the consequences or tendencies of all their actions towards one or other of these, especially where those tendencies are intricate and point different ways, or those consequences remote and complicated: or though, by careful and cool inquiry, and a due improvement of their rational powers, they might find them out; yet distracted as they are with business, amused with trifles, dissipated by pleasure, and disturbed by passion, they either have, or can find, no leisure to attend to those consequences, or to examine how far this or that conduct is productive of private or public good on the whole. Therefore, were it left entirely to the slow and sober deductions of reason to trace those tendencies and make out those consequences, it is evident, that, in many particular instances, the business of life must stand still, and many important occasions of action be lost, or perhaps the greatest blunders be committed. On this account the Deity, besides that general approbation which we bestow on every degree of kind affection, has moreover implanted in man many particular perceptions, or determinations, to approve of certain qualities or actions, which, in effect, tend to the advantage of society, and are connected with private good, though he does not always see that tendency, nor mind that connection. And these perceptions or determinations do, without reasoning, point out, and, antecedent to views of interest, prompt to a conduct beneficial to the public, and useful to the private system. Such is that sense of candor and veracity, that abhorrence of fraud and falsehood, that sense of fidelity, justice, gratitude, greatness of mind, fortitude, clemency, decorum; and that disapprobation of knavery, injustice, ingratitude, meanness of spirit, cowardice, cruelty and indecorum, which are natural to the human mind. The former of those dispositions, and the actions flowing from them, are approved, and those of the latter kind disapproved by us, even abstracted from the view of their tendency or conduciveness to the happiness or misery of others or of ourselves. In one we discern a beauty, a superior excellency, a congruity to the dignity of man; in the other a deformity, a littleness, a debasement of human nature.

There are other principles also, connected with the good of society, or the happiness and perfection of the individual, though that connection is not immediately apparent, which we behold with real complacency and approbation, though perhaps inferior in degree, if not in kind; such as gravity, modesty, simplicity of deportment, temperance, prudent oeconomy; and we feel some degree of contempt and dislike where they are wanting, or where the opposite qualities prevail. These and the like perceptions or feelings are either different modifications of the moral sense, or subordinate to it, and plainly serve the same important purpose, being expeditious monitors in the several emergencies of a various and distracted life, of

what is right, what is wrong, what is to be pursued, and what avoided; and, by the pleasant or painful consciousness which attends them, exerting their influence as powerful prompters to a suitable conduct.

From a slight inspection of the above-named principles, it is evident they all carry a friendly aspect to society and the individual, and have a more immediate or a more remote tendency to promote the perfection or good of both. This tendency cannot be always foreseen, and would be often mistaken, or seldom attended to by a weak, busy, short-sighted creature, like man, both rash and variable in his opinions, a dupe to his own passions or to the designs of others, liable to sickness, to want, and to error. Principles, therefore, which are so nearly linked with private security and public good, by directing him, without operose reasoning, where to find one, and how to promote the other, and by prompting him to a conduct conducive to both, are admirably adapted to the exigencies of his present state, and wisely calculated to obtain the ends of universal benevolence.

It were easy, by considering the subject in another light, to shew, in a curious detail of particulars, how wonderfully the inside of man, or that astonishing train of moral powers and affections with which he is endued, is fitted to the several stages of that progressive and probationary state, through which he is destined to pass. As our faculties are narrow and limited, and rise from very small and imperfect beginnings, they must be improved by exercise, by attention, and repeated trials. And this holds true, not only of our intellectual, but of our moral and active powers. The former are liable to errors in speculation, the latter to blunders in practice, and both often terminate in misfortunes and pains: and those errors and blunders are generally owing to our passions, or to our too forward and warm admiration of those partial goods they naturally pursue, or to our fear of those partial ills they naturally repel. Those misfortunes therefore lead us back to consider where our misconduct lay, and whence our errors flowed; and consequently are salutary pieces of trial, which tend to enlarge our views, to correct and refine our passions, and consequently improve both our intellectual and moral powers.—Our passions then are the rude materials of our virtue, which heaven has given us to work up, to refine and polish into an harmonious and divine piece of workmanship. They furnish out the whole machinery, the calms and storms, the lights and shades of human life. They shew mankind in every attitude and variety of character, and give virtue both its struggles and its triumphs. To conduct them well in every state, is merit; to abuse or misapply them, is demerit.

The different sets of senses, powers, and passions, which unfold themselves in those successive stages, are both necessary, and adapted to that rising and progressive state. Enlarging views and growing connections require new passions and new habits; and thus the mind, by these continually expanding and finding a progressive exercise, rises to higher improvements, and pushes forward to maturity and perfection.

In this beautiful oeconomy and harmony of our structure, both outward and inward, with that state, we may

at once discern the great lines of our duty traced out in the fairest and brightest characters, and contemplate with admiration a more august and marvellous scene of divine wisdom and goodness laid in the human breast, than we shall perhaps find in the whole compass of nature.

From this detail it appears, that man, by his original frame, is made for a temperate, compassionate, benevolent, active, and progressive state. He is strongly attractive of the good, and repulsive of the ill, which befall others as well as himself. He feels the highest approbation and moral complacency in those affections and in those actions which immediately and directly respect the good of others, and the highest disapprobation and abhorrence of the contrary. Besides these, he has many particular perceptions or instincts of approbation, which though perhaps not of the same kind with the others, yet are accompanied with correspondent degrees of affection, proportioned to their respective tendencies to the public good. Therefore, by acting agreeably to these principles, man acts agreeably to his structure, and fulfils the benevolent intentions of its Author.

#### *The principal Distinctions of Duty or Virtue.*

WE have now considered the constitution and connections of man; and on these erected a general system of duty or moral obligation, consonant to reason, approved by his most sacred and intimate sense; suitable to his mixed condition, and confirmed by the experience of mankind. We have also traced the final causes of his moral faculties and affections to those noble purposes they answer with regard both to the private and the public system.

From this induction it is evident, that there is one order or class of duties which man owes to himself; another to society; and a third to God.

The duties he owes to himself are founded chiefly on the defensive and private passions, which prompt him to pursue whatever tends to private good or happiness, and to avoid or ward off whatever tends to private ill or misery. Among the various goods which allure and solicit him, and the various ills which attack or threaten him, "To be intelligent and accurate in selecting one, and rejecting the other, or in preferring the most excellent goods, and avoiding the most terrible ills, when there is a competition among either, and to be discreet in using the best means to attain the goods and avoid the ills, is what we call prudence." This, in our inward frame, corresponds to sagacity, or a quickness of sense in our outward.—"To proportion our defensive passions to our dangers, we call fortitude;" which always implies "a just mixture of calm resentment or animosity, and well governed caution." And this firmness of mind answers to the strength and muscling of the body.—And "duly to adjust our private passions to our wants, or to the respective moment of the good we affect or pursue, we call temperance;" which does therefore always imply "a just balance or command of the passions."

The second class of duties arises from the public or social affections; "the just harmony or proportion of which to the dangers and wants of others, and to the se-

veral relations we bear, commonly goes by the name of justice." This includes the whole of our duty to society, to its parent, and the general polity of nature; particularly gratitude, friendship, sincerity, natural affection, benevolence, and the other social virtues. The virtues comprehended under the former class, especially prudence and fortitude, may likewise be transferred to this; and according to the various circumstances in which they are placed, and the more confined or more extensive sphere in which they operate, may be denominated private, economical, or civil prudence, fortitude, &c. These direct our conduct with regard to the wants and dangers of those lesser or greater circles with which we are connected.

The third class of duties respects the Deity, and arises also from the public affections, and the several glorious relations which he sustains to us, as our creator, benefactor, law-giver, judge, &c.

We chose to consider this set of duties in the last place, because, though prior in dignity and excellency, they seem to be last in order of time, as thinking it the most simple and easy method to follow the gradual progress of nature, as it takes its rise from individuals, and spreads through the social system, and still ascends upwards, till at length it stretches to its almighty Parent and Head, and so terminates in those duties which are highest and best.

The duties resulting from these relations, are reverence, gratitude, love, resignation, dependence, obedience, worship, praise; which, according to the model of our finite capacities, must maintain some sort of proportion to the grandeur and perfection of the object whom we venerate, love, and obey. "This proportion or harmony, is expressed by the general name of piety or devotion;" which is always stronger or weaker, according to the greater or less apprehended excellency of its object. This sublime principle of virtue, is the enlivening soul which animates the moral system, and that cement which binds and sustains the other duties which man owes to himself or to society.

This then is the general temper and constitution of virtue, and these are the principal lines or divisions of duty. To those good dispositions, which respect the several objects of our duty, and to all actions which flow from such dispositions, the mind gives its sanction or testimony. And this sanction or judgment concerning the moral quality, or the goodness of actions or dispositions, moralists call conscience. When it judges of an action that is to be performed, it is called an antecedent conscience; and when it passes sentence on an action which is performed, it is called a subsequent conscience. The tendency of an action to produce happiness, or its external conformity to a law, is termed its material goodness; but the good dispositions from which an action proceeds, or its conformity to law in every respect, constitutes its formal goodness.

When the mind is ignorant or uncertain about the moment of an action, or its tendency to private or public good; or when there are several circumstances in the case, some of which being doubtful, render the mind dubious concerning the morality of the action; this is called a doubtful or scrupulous conscience: if it mistakes concern-

*Fig. 1. MUS PORCELLUS or  
Guiney Pig*



*Fig. 2. MUS AGUTI*



*Fig. 3. MUS AVELLONARIUS*





Fig. 1. MUS MARMOTTA  
or, Alpine mouse.

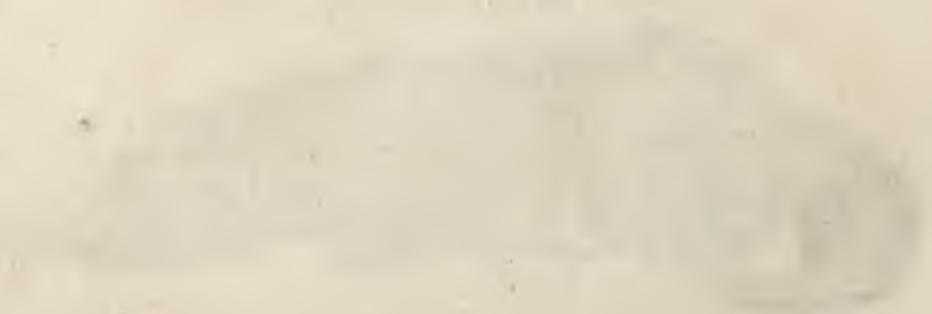


Fig. 2. MUS VOLANS  
or, Flying Squirrel.



Fig. 3. MUSTELA LUTRA or Otter.





*Fig. 1. MUSTELA PUTORIUS or Polecat.*



*Fig. 2. MUSTELA FUR O or Ferret.*



*Fig. 4. MYRMECOPHAGA.*



*Fig. 3 MUSTELA ERMINA or Ermine.*

*Fig. 5. MULLET.*





FIG. 1. Mountain goat (Capra montanus).



FIG. 2. Mountain goat (Capra montanus).



FIG. 3. Mountain goat (Capra montanus).

ing these, it is called an erroneous conscience. If the error or ignorance is involuntary or invincible, the action proceeding from that error, or from that ignorance, is reckoned innocent, or not imputable. If the error or ignorance is supine or affected, *i. e.* the effect of negligence, or of affectation and wilful inadvertence, the conduct flowing from such error, or such ignorance, is criminal and imputable. Not to follow one's conscience, though erroneous and ill-formed, is criminal, as it is the guide of life; and to counteract it, shews a depraved and incorrigible spirit: Yet, to follow an erroneous conscience is likewise criminal, if that error which misled the conscience was the effect of inattention, or of any criminal passion.

If it be asked, "How an erroneous conscience shall be rectified, since it is supposed to be the only guide of life, and judge of morals?" we answer, In the very same way that we would rectify reason, if at any time it should judge wrong, as it often does, *viz.* By giving it proper and sufficient materials for judging right, *i. e.* by inquiring into the whole state of the case; the relations, connections, and several obligations of the actor; the consequences, and other circumstances of the action; or the surplusage of private or public good which results, or is likely to result, from the action or from the omission of it. If those circumstances are fairly and fully stated, the conscience will be just and impartial in its decision. For, by a necessary law of our nature, it approves, and is well affected to the moral form; and if it seems to approve of vice or immorality, it is always under the notion or mask of some virtue. So that, strictly speaking, it is not conscience which errs; for its sentence is always conformable to the view of the case which lies before it; and is just, upon the supposition that the case is truly such as it is represented to it. All the fault is to be imputed to the agent, who neglects to be better informed, or who, thro' weakness or wickedness, hastens to pass sentence from an imperfect evidence.

*Of Man's Duty to HIMSELF. Of the Nature of GOOD, and the CHIEF GOOD.*

EVERY creature, by the constitution of his nature, is determined to love himself, to pursue whatever tends to his preservation and happiness, and to avoid whatever tends to his hurt and misery. Being endued with sense and perception, he must necessarily receive pleasure from some objects, and pain from others. Those objects which give pleasure are called good, and those which give pain evil. To the former he feels that attraction or motion we call desire, or love: To the latter that impulse we call aversion or hatred. To objects which suggest neither pleasure nor pain, and are apprehended of no use to procure one, or ward off the other, we feel neither desire nor aversion; and such objects are called indifferent. Those objects which do not of themselves produce pleasure or pain, but are the means of procuring either, we call useful or noxious. Towards them we are affected in a subordinate manner, or with an indirect and reflective, rather than a direct and immediate affection. All the original and particular affections of our nature, lead us out to, and ultimately rest in, the first kind of objects,

*viz.* those which give immediate pleasure, and which we therefore call good, directly so. The calm affection of self-love alone is conversant about such objects as are only consequentially good, or merely useful to ourselves.

But besides those sorts of objects which we call good, merely and solely as they give pleasure, or are means of procuring it, there is an higher and nobler species of good, towards which we feel that peculiar movement we call approbation or moral complacency, and which we therefore denominate moral good. Such are our affections, and the consequent actions to them. The perception of this is quite distinct in kind from the perception of the other species; and though it may be connected with pleasure or advantage by the benevolent constitution of nature, yet it constitutes a good independent of that pleasure and that advantage, and far superior, not in degree only, but in dignity, to both. The other, *viz.* the natural good, consists in obtaining those pleasures which are adapted to the peculiar senses and passions susceptible of them, and is as various as are those senses and passions. This, *viz.* the moral good, lies in the right conduct of the several senses and passions, or their just proportion and accommodation to their respective objects and relations; and this is of a more simple and invariable kind.

By our several senses we are capable of a great variety of pleasing sensations. These constitute distinct ends or objects ultimately pursuable for their own sake. To these ends, or ultimate objects, correspond peculiar appetites or affections, which prompt the mind to pursue them. When these ends are attained, there it rests and looks no farther. Whatever therefore is pursuable, not on its own account, but as subservient or necessary to the attainment of something else that is intrinsically valuable or for its own sake, we call a mean, and not an end. So that ends, and not means, constitute the materials or the very essence of our happiness. Consequently, happiness cannot be one simple uniform thing in creatures constituted, as we are, with such various senses of pleasure, or such different capacities of enjoyment. Now, the same principle or law of our nature which determines us to pursue any one end or species of good, prompts us to pursue every other end or species of good of which we are susceptible, or to which our Maker has adapted an original propension. But amidst the great multiplicity of ends or goods, which form the various ingredients of our happiness, we perceive an evident gradation or subordination, suited to that gradation of senses, powers, and passions, which prevails in our mixed and various constitution, and to that ascending series of connections which open upon us in the different stages of our progressive state.

Thus the goods of the body, or of the external senses, seem to hold the lowest rank in this gradation or scale of goods. These we have in common with the brutes; and though many men are brutish enough to pursue the goods of the body with a more than brutal fury; yet when at any time they come in competition with goods of an higher order, the unanimous verdict of mankind, by giving the last the preference, condemns the first to the

means place. Goods consisting in exterior social connections, as fame, fortune, power, civil authority, seem to succeed next, and are chiefly valuable as the means of procuring natural or moral good, but principally the latter. Goods of the intellect are still superior; as taste, knowledge, memory, judgment, &c. The highest are moral goods of the mind, directly and ultimately regarding ourselves; as command of the appetites and passions, prudence, fortitude, benevolence, &c. These are the great objects of our pursuit, and the principal ingredients of our happiness. Let us consider each of them, as they rise one above the other in this natural series or scale, and touch briefly on our obligations to pursue them.

Those of the body are health, strength, agility, hardiness, and patience of change, neatness, and decency.

Good health, and a regular easy flow of spirits, are in themselves sweet natural enjoyments, a great fund of pleasure, and indeed the proper seasoning which gives a flavour and poignancy to every other pleasure. The want of health unfits us for most duties of life, and is especially an enemy to the social and human affections, as it generally renders the unhappy sufferer peevish and sullen, disgusted at the allotments of providence, and consequently apt to entertain suspicious and gloomy sentiments of its Author. It obstructs the free exercise and full improvement of our reason, makes us a burden to our friends, and useless to society. Whereas the uninterrupted enjoyment of good health, is a constant source of good humour: and good humour is a great friend to openness and benignity of heart; enables us to encounter the various ills and disappointments of life with more courage, or to sustain them with more patience; and, in short, conduces much, if we are otherwise duly qualified, to our acting our part in every exigency of life with more firmness, consistency, and dignity. Therefore it imports us much to preserve and improve an habit or enjoyment, without which every other external entertainment is tasteless, and most other advantages of little avail. And this is best done by a strict temperance in diet and regimen, by regular exercise, and by keeping the mind serene and untroubled by violent passions, and unsubdued by intense and constant labours, which greatly impair, and gradually destroy, the strongest constitutions.

Strength, agility, hardiness, and patience of change, suppose health, and are unattainable without it; but they imply something more, and are necessary to guard it, to give us the perfect use of life and limbs, and to secure us against many otherwise unavoidable ills. The exercise of the necessary manual, and of most the elegant arts of life, depends on strength and agility of body; personal dangers, private and public dangers, the demands of our friends, our families and country require them; they are necessary in war, and ornamental in peace; fit for the employments of a country and a town life, and they exalt the entertainments and diversions of both. They are chiefly obtained by moderate and regular exercise.

Few are so much raised above want and dependence, or so exempted from business and care, as not to be often exposed to inequalities and changes of diet, exercise, air, climate, and other irregularities. Now, what can be so effectual to secure one against the mischiefs arising from

such unavoidable alterations, as hardiness, and a certain versatility of constitution, which can bear extraordinary labours, and submit to great changes, without any sensible uneasiness or bad consequences. This is best attained, not by an over great delicacy and minute attentions to forms, or by an invariable regularity in diet, hours, and way of living, but rather by a bold discreet latitude of regimen. Besides, deviations from established rules and forms of living, if kept within the bounds of sobriety and reason, are friendly to thought and original sentiment, and agreeably stir the passions, which stagnate or breed ill humour in the calms of life.

Neatness, cleanliness, and decency, to which we may add dignity of countenance and demeanour, seem to have something refined and moral in them. At least we generally esteem them indications of an orderly, genteel, and well governed mind, conscious of inward worth, or the respect due to one's nature. Whereas nastiness, slovenliness, awkwardness, and indecency, are shrewd symptoms of something mean, careless, and deficient, and betray a mind untaught, illiberal, unconscious of what is due to one's self or to others. How much cleanliness conduces to health needs hardly to be mentioned; and how necessary it is to maintain one's character and rank in life, and to render us agreeable to others as well as to ourselves, is as evident.—There are certain motions, airs and gestures, which become the human countenance and form, in which we perceive a comeliness, openness, simplicity, gracefulness; and there are others, which, to our sense of decorum, appear uncomely, affected, disingenuous, and awkward, quite unsuitable to the native dignity of our face and form. The first are in themselves the most easy, natural, and commodious; give one boldness and presence of mind, a modest assurance, an address both awful and alluring, they bespeak candour and greatness of mind, raise the most agreeable prejudices in one's favour, render society engaging, command respect, and often love, and give weight and authority both in conversation and business: in fine, they are the colouring of virtue, which shew it to the greatest advantage in whomsoever it is; and not only imitate, but in some measure supply it where it is wanting. Whereas the last, *viz.* rudeness, affectation, indecorum, and the like, have all the contrary effects; they are burdensome to one's self, a dishonour to our nature and a nuisance in society. The former qualities or goods are best attained by a liberal education, by preserving a just sense of the dignity of our nature, by keeping the best and politest company; but above all, by acquiring those virtuous and ennobling habits of mind, which are decency in perfection, which will give an air of unaffected grandeur, and spread a lustre truly engaging over the whole form and deportment.

We are next to consider those goods which consist in exterior social connections; as fame, fortune, civil authority, power.

The first has a twofold aspect; as a good pleasant in itself, or gratifying to an original passion; and then, as expedient or useful towards a farther end. Honour from the wife and good, on the account of a virtuous consort, is regalating to a good man. There are few quite indifferent

even to the commendation of the vulgar. Though we cannot approve that conduct which proceeds entirely from this principle, and not from good affection or love of the conduct itself; yet as it is often a guard and additional motive to virtue in creatures imperfect as we are, and often distracted by interfering passions, it might be dangerous to suppress it altogether, however wise it may be to restrain it within due bounds, and however laudable to use it only as a scaffolding to our virtue, which may be taken down when that glorious structure is finished, but hardly till then. To pursue fame for itself, is innocent; to regard it only as an auxiliary to virtue, is noble; to seek it chiefly as an engine of public usefulness, is still more noble. For though the opinion and breath of men are transient and fading things; often obtained without merit, and lost without cause: yet as our business is with men, and as our capacity of serving them is generally increased in proportion to their esteem of us; therefore sound and well established moral applause may, and will be, modestly, not ostentatiously, sought after by the good; not indeed as a solitary refined sort of luxury, but as a public and proper instrument to serve and bless mankind. At the same time they will learn to despise that reputation which is founded on rank, fortune, and any other circumstances or accomplishments that are foreign to real merit, or to useful services done to others; and think that praise of little avail which is purchased without desert, and bestowed without judgment.

Fortune, power, and civil authority, or whatever is called influence and weight among mankind, are goods of the second division; that is, valuable and pursuable only as they are useful, or as means to a farther end, *viz.* the procuring or preserving the immediate objects of enjoyment or happiness to ourselves or others. Therefore, to love such goods on their own account, and to pursue them as ends, not the means of enjoyment, must be highly preposterous and absurd. There can be no measure, no limit to such pursuit; all must be whim, caprice, extravagance. Accordingly, such appetites, unlike all the natural ones, are increased by possession, and whetted by enjoyment. They are always precarious, and never without fears because the objects lie without one's self; they are seldom without sorrow and vexation, because no accession of wealth or power can satisfy them. But if those goods are considered only as the materials or means of private or public happiness; then the same obligations which bind us to pursue the latter, bind us likewise to pursue the former. We may, and no doubt we ought, to seek such a measure of wealth as is necessary to supply all our real wants, to raise us above servile dependence, and provide us with such conveniences as are suited to our rank and condition in life. To be regardless of this measure of wealth is to expose ourselves to all the temptations of poverty and corruption; to forfeit our natural independency and freedom; to degrade, and consequently to render the rank we hold, and the character we sustain in society, useless, if not contemptible. When these important ends are secured, we ought not to murmur or repine that we possess no more; yet we are not freed by any obligation, moral or divine, from seeking more, in order to give us that happiest and most God-like of all powers, the power of doing

good. A supine indolence in this respect is both absurd and criminal; absurd, as it robs us of an inexhausted fund of the most refined and durable enjoyments; and criminal, as it renders us so far useless to the society to which we belong. "That pursuit of wealth which goes beyond the former end, *viz.* the obtaining the necessaries, or such conveniences of life, as in the estimation of reason, not of vanity or passion, are suited to our rank and condition, and yet is not directed to the latter, *viz.* the doing good, is what we call avarice." And "that pursuit of power, which, after securing one's self, *i. e.* attaining the proper independence and liberty of a rational social creature, is not directed to the good of others, is what we call ambition, or the lust of power." To what extent the strict measures of virtue will allow us to pursue either wealth, or power, and civil authority, is not perhaps possible precisely to determine. That must be left to prudence, and the peculiar character, condition, and other circumstances of each man. Only thus far a limit may be set, that the pursuit of either must encroach upon no other duty or obligation which we owe to ourselves, to society, or to its Parent and Head. The same reasoning is to be applied to power as to wealth. It is only valuable as an instrument of our own security, and of the free enjoyment of those original goods it may, and often does, administer to us; and as an engine of more extensive happiness to our friends, our country, and mankind.

Now the best, and indeed the only way to obtain a solid and lasting fame, is an uniform inflexible course of virtue, the employing one's ability and wealth in supplying the wants, and using one's power in promoting or securing the happiness, the rights and liberties of mankind, joined to an universal affability and politeness of manners. And surely one will not mistake the matter much, who thinks the same course conducive to the acquiring greater accessions both of wealth and power: especially if he adds to those qualifications a vigorous industry, a constant attention to the characters and wants of men, to the conjunctures of times, and continually varying genius of affairs; and a steady intrepid honesty, that will neither yield to the allurements, nor be overawed with the terrors of that corrupt and corrupting scene in which we live. We have sometimes heard, indeed, of other ways and means, as fraud, dissimulation, servility, and prostitution, and the like ignoble arts, by which the men of the world (as they are called, shrewd politicians, and men of address!) amass wealth, and procure power: but as we want rather to form a man of virtue, an honest, contented, happy man, we leave to the men of the world their own ways, and permit them unenvied, and unimitated by us, to reap the fruit of their doings.

The next species of objects in the scale of good, are the goods of the intellect; as knowledge, memory, judgment, taste, sagacity, docility, and whatever else we call intellectual virtues. Let us consider them a little, and the means as well as obligations to improve them.

As man is a rational creature, capable of knowing the differences of things and actions;—as he not only sees and feels what is present, but remembers what is past, and often foresees what is future;—as he advances, from small beginnings

beginnings, by slow degrees, and with much labour and difficulty, to knowledge and experience;—as his opinions sway his passions;—as his passions influence his conduct,—and as his conduct draws consequences after it, which extend not only to the present, but to the future-time, and therefore is the principal source of his happiness or misery;—it is evident, that he is formed for intellectual improvements, and that it must be of the utmost consequence for him to improve and cultivate his intellectual powers, on which those opinions, those passions, and that conduct depend.

But besides the future consequences and moment of improving our intellectual powers, their immediate exercise on their proper objects yields the most rational and refined pleasures. Knowledge and a right taste in the arts of imitation and design, as poetry, painting, sculpture, music, architecture, afford not only an innocent, but a most sensible and sublime entertainment. By these the understanding is instructed in ancient and modern life, the history of men and things, the energies and effects of the passions, the consequences of virtue and vice; by these the imagination is at once entertained and nourished with the beauties of nature and art, lighted up and spread out with the novelty, grandeur, and harmony of the universe; and in fine, the passions are agreeably roused, and suitably engaged by the greatest and most interesting objects that can fill the human mind. He who has a taste formed to these ingenious delights, and plenty of materials to gratify it, can never want the most agreeable exercise and entertainment, nor once have reason to make that fashionable complaint of the tediousness of time. Nor can he want a proper subject for the discipline and improvement of his heart. For being daily conversant with beauty, order and design, in inferior subjects, he bids fair for growing in due time an admirer of what is fair and well-proportioned in the conduct of life, and the order of society, which is only order and design exerted in their highest subject. He will learn to transfer the numbers of poetry to the harmony of the mind, and of well-governed passions; and from admiring the virtues of others in moral paintings, come to approve and imitate them himself. Therefore to cultivate a true and correct taste, must be both our interest and our duty, when the circumstances of our station give leisure and opportunity for it, and when the doing it is not inconsistent with our higher obligations or engagements to society and mankind.

It is best attained by reading the best books, where good sense has more the ascendant than learning, and which retain more to practice than to speculation; by studying the best models, *i. e.* those which profess to imitate nature most, and approach the nearest to it; and by conversing with men of the most refined taste, and the greatest experience in life.

As to the other intellectual goods, what a fund of entertainment must it be to investigate the truth and various relations of things; to trace the operations of nature to general laws; to explain by these its manifold phenomena; to understand that order by which the universe is upheld, and that economy by which it is governed; to be acquainted with the human mind, the connection, subor-

dinations, and uses of its powers, and to mark their energy in life! How agreeable to the ingenious inquirer, to observe the manifold relations and combinations of individual minds in society; to discern the causes why they flourish or decay; and from thence to ascend, through the vast scale of beings, to that General Mind which presides over all, and operates unseen in every system, and in every age, through the whole compass and progression of nature! Devoted to such entertainments as these, the contemplative have abandoned every other pleasure, and sequestered themselves from social intercourse; for these the busy have often preferred, to the hurry and din of life, the calm retreats of contemplation; for these, when once they came to taste them, even the gay and voluptuous have thrown up the lawless pursuits of sense and appetite, and acknowledged these mental enjoyments to be the most refined, and indeed the only luxury. Besides, by a just and large knowledge of nature, we recognize the perfections of its Author; and thus piety, and all those pious affections which depend on just sentiments of his character, are awakened and confirmed; and a thousand superstitious fears, that arise from partial views of his nature and works, will of course be excluded. An extensive prospect of human life, and of the periods and revolutions of human things, will conduce much to the giving a certain greatness of mind, and a noble contempt of those little competitions about power, honour, and wealth, which disturb and divide the bulk of mankind; and promote a calm indurance of those inconveniences and ills that are the common appendages of humanity. Add to all, that a just knowledge of human nature, and of those hinges upon which the business and fortunes of men turn, will prevent our thinking either too highly, or too meanly of our fellow-creatures; give no small scope to the exercise of friendship, confidence, and goodwill; and, at the same time, brace the mind with a proper caution and distrust, and give a greater mastery in the conduct of private as well as public life. Therefore, by cultivating our intellectual abilities, we shall best promote and secure our interest, and be qualified for acting our part in society with more honour to ourselves, as well as advantage to mankind. Consequently, to improve them to the utmost of our power is our duty; they are talents committed to us by the Almighty Head of society, and we are accountable to him for the use of them.

The intellectual virtues are best improved by accurate and impartial observation, extensive reading, and unconfined converse with men of all characters, especially with those who, to private study, have joined the widest acquaintance with the world and greatest practice in its affairs; but above all, by being much in the world, and having large dealings with mankind. Such opportunities contribute much to divest one of prejudices and a servile attachment to crude systems, to open one's views, and to give that experience on which the most useful knowledge is built, and from which the surest maxims for the conduct of life are deduced.

The highest goods which enter into the composition of human happiness are moral goods of the mind, directly and ultimately regarding ourselves; as command of the appetites and passions, prudence and caution, magnanimity, fortitude,

fortitude, humility, love of virtue, love of God, resignation, and the like. These sublime goods are, by way of eminence, goods recommended and enforced by the most intimate and awful sense and consciousness of our nature; goods that constitute the quintessence of happiness, that form and completion of soul which renders us approveable and lovely in the sight of God; goods, in fine, which are the elements of all our future perfection and felicity.

Most of the other goods we have considered depend partly on ourselves, and partly on accidents which we can neither foresee nor prevent, and result from causes which we cannot influence or alter. They are such goods as we may possess to-day and lose to-morrow, and which require a felicity of constitution and talents to attain them in full vigour and perfection, and a felicity of conjunctures to secure the possession of them. Therefore, did our happiness depend altogether or chiefly on such transitory and precarious possessions, it were itself most precarious, and the highest folly to be anxious about it.—But though creatures, constituted as we are, cannot be indifferent about such goods, and must suffer in some degree, and consequently have our happiness incomplete without them, yet they weigh but little in the scale when compared with moral goods. By the benevolent constitution of our nature, these are placed within the sphere of our activity, so that no man can be destitute of them unless he is first wanting to himself. Some of the wisest and best of mankind have wanted most of the former goods, and all the external kind, and felt most of the opposite ills; yet, by possessing the latter, have declared they were happy, and to the conviction of the most impartial observers have appeared happy. The worst of men have been surrounded with every outward good and advantage of fortune, and have possessed great parts; yet, for want of moral rectitude, have been notoriously and exquisitely miserable. The exercise of virtue has supported its votaries, and made them exult in the midst of tortures almost intolerable; nay, how often has some false form or shadow of it sustained even the greatest villains and bigots under the same pressures! But no external goods, no goods of fortune, have been able to alleviate the agonies, or expel the fears of a guilty mind, conscious of the deserved hatred and reproach of mankind, and the just displeasure of almighty God.

As the present condition of human life is wonderfully chequered with good and ill; and as no height of station, no affluence of fortune, can absolutely insure the good or secure against the ill; it is evident, that a great part of the comfort and serenity of life must lie in having our minds duly affected with regard to both, *i. e.* rightly attempered to the loss of one and the sufferance of the other. For it is certain, that outward calamities derive their chief malignity and pressure from the inward dispositions with which we receive them. By managing these right, we may greatly abate that malignity and pressure, and consequently diminish the number and weaken the moment of the ills of life, if we should not have it in our power to obtain a large share of its goods. There are particularly three virtues which go to the forming this right temper towards ill, and which are of singular efficacy, if

not totally to remove, yet wonderfully to alleviate the calamities of life. These are fortitude, or patience, humility, and resignation.

Fortitude is that calm and steady habit of mind, which either moderates our fears, and enables us bravely to encounter the prospect of ill, or renders the mind serene and invincible under its immediate pressure. It lies equally distant from rashness and cowardice; and though it does not hinder us from feeling, yet prevents our complaining or shrinking under the stroke. It always includes a generous contempt of, or at least a noble superiority to, those precarious goods of which we can insure neither the possession nor continuance. The man therefore who possesses this virtue in this ample sense of it, stands upon an eminence, and sees human things below him; the tempest indeed may reach him, but he stands secure and collected against it upon the basis of conscious virtue, which the severest storms can seldom shake, and never overthrow.

Humility is another virtue of high rank and dignity, though often mistaken by proud mortals for meanness and pusillanimity. It is opposed to pride, which commonly includes in it a false or over-rated estimation of our own merit, an ascription of it to ourselves as its only and original cause, an undue comparison of ourselves with others, and, in consequence of that supposed superiority, an arrogant preference of ourselves, and a supercilious contempt of them. Humility, on the other hand, seems to denote that modest and ingenuous temper of mind, which arises from a just and equal estimate of our own advantages compared with those of others, and from a sense of our deriving all originally from the Author of our being. Its ordinary attendants are mildness, a gentle forbearance, and an easy unassuming humanity with regard to the imperfections and faults of others; virtues rare indeed, but of the fairest complexion, the proper offspring of so lovely a parent, the best ornaments of such imperfect creatures as we are, precious in the sight of God, and which sweetly allure the hearts of men.

Resignation is that mild and heroic temper of mind, which arises from a sense of an infinitely wise and good providence, and enables one to acquiesce with a cordial affection in its just appointments. This virtue has something very peculiar in its nature, and sublime in its efficacy. For it teaches us to bear ill, not only with patience, and as being unavoidable; but it transforms, as it were, ill into good, by leading us to consider it, and every thing that has the least appearance of ill, as a divine dispensation, a wise and benevolent temperament of things, subservient to universal good, and of course including that of every individual, especially of such as calmly stoop to it. In this light, the administration itself, nay, every act of it, becomes an object of affection; the evil disappears, or is converted into a balm which both heals and nourishes the mind. For, though the first unexpected access of ill may surprize the soul into grief; yet that grief, when the mind calmly reviews its object, changes into contentment, and is by degrees exalted into veneration and a divine composure. Our private will is lost in that of the Almighty, and our security against every real ill rests on the same bottom as the throne of Him who lives and reigns for ever.

Before we finish this section, it may be fit to observe, that as the Deity is the supreme and inexhausted source of good, on whom the happiness of the whole creation depends; as he is the highest object in nature, and the only object who is fully proportioned to the intellectual and moral powers of the mind, in whom they ultimately rest and find their most perfect exercise and completion; he is therefore termed the *chief good* of man *objectively* considered: And virtue, or the proportioned and vigorous exercise of the several powers and affections on their respective objects, as above described, is, in the schools, termed the *chief good formally* considered, or its *formal idea*, being the inward temper and native constitution of human happiness.

From the detail we have gone through, the following corollaries may be deduced.

1. It is evident that the happiness of such a progressive creature as man can never be at a stand, or continue a fixed invariable thing. His finite nature, let it rise ever so high, admits still higher degrees of improvement and perfection: and his progression in improvement, or virtue, always makes way for a progression in happiness. So that no possible point can be assigned in any period of his existence in which he is perfectly happy, that is, so happy as to exclude higher degrees of happiness. All his perfection is only comparative. 2. It appears that many things must conspire to complete the happiness of so various a creature as man, subject to so many wants, and susceptible of such different pleasures. 3. As his capacities of pleasure cannot be all gratified at the same time, and must often interfere with each other in such a precarious and fleeting state as human life, or be frequently disappointed, perfect happiness, *i. e.* the undisturbed enjoyment of the several pleasures of which we are capable, is unattainable in our present state. 4. That state is most to be sought after, in which the fewest competitions and disappointments can happen, which least of all impairs any sense of pleasure, and opens an inexhausted source of the most refined and lasting enjoyments. 5. That state which is attended with all those advantages is a state or course of virtue. 6. Therefore, a state of virtue, in which the moral goods of the mind are attained, is the happiest state.

#### DUTIES to SOCIETY.

##### *Filial and Fraternal duty.*

As we have followed the order of nature in tracing the history of man, and those duties which he owes to himself; it seems reasonable to take the same method with those he owes to society, which constitute the second class of his obligations.

His parents are among the earliest objects of his attention; he becomes soonest acquainted with them, reposes a peculiar confidence in them, and seems to regard them with a fond affection, the early prognostics of his future piety and gratitude. Thus does nature dictate the first lines of filial duty, even before a just sense of the connection is formed. But when the child is grown up, and has attained to such a degree of understanding as to comprehend the moral tie, and be sensible of the obligations

he is under to his parents; when he looks back on their tender and disinterested affection, their incessant cares and labours in nursing, educating and providing for him during that state in which he had neither prudence nor strength to care and provide for himself; he must be conscious that he owes to them these peculiar duties.

1. To reverence and honour them as the instruments of nature in introducing him to life, and to that state of comfort and happiness which he enjoys; and therefore to esteem and imitate their good qualities, to alleviate and bear with, and spread as much as possible a decent veil over their faults and weaknesses.

2. To be highly grateful to them for those favours which it can hardly ever be in his power fully to repay; to shew this gratitude by a strict attention to their wants, and a solicitous care to supply them; by a submissive deference to their authority and advice; by yielding to, rather than peevishly contending with their humours, as remembering how oft they have been persecuted by his; and in fine, by soothing their cares, lightening their sorrows, supporting the infirmities of age, and making the remainder of their life as comfortable and joyful as possible.

As his brethren and sisters are the next with whom the creature forms a social and moral connection, to them he owes a fraternal regard; and with them ought he to enter into a strict league of friendship, mutual sympathy, advice, assistance, and a generous intercourse of kind offices, remembering their relation to common parents, and that brotherhood of nature which unites them into a closer community of interest and affection.

##### *Concerning Marriage.*

WHEN man arrives to a certain age, he becomes sensible of a peculiar sympathy and tenderness towards the other sex; the charms of beauty engage his attention, and call forth new and softer dispositions than he has yet felt. The many amiable qualities exhibited by a fair outside, or by the mild allurement of female manners, or which the prejudiced spectator without much reasoning supposes those to include, with several other circumstances, point his view and affection to a particular object, and of course contract that general rambling regard, which was lost and useless among the undistinguished croud, into a peculiar and permanent attachment to one woman, which ordinarily terminates in the most important, venerable, and delightful connection in life.

The state of the brute-creation is very different from that of human creatures. The former are clothed and generally armed by their structure, easily find what is necessary to their subsistence, and soon attain their vigour and maturity; so that they need the care and aid of their parents but for a short while; and therefore we see that nature has assigned to them vagrant and transient amours. The connection being purely natural, and formed merely for propagating and rearing their offspring; no sooner is that end answered, than the connection dissolves of course. But the human race are of a more tender and defenceless constitution; their infancy and non-age continue longer; they advance slowly to strength of body, and maturity of reason; they need constant attention, and a long series of

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cares and labours to train them up to decency, virtue, and the various arts of life. Nature has, therefore, provided them with the most affectionate and anxious tutors, to aid their weakness, to supply their wants, and to accomplish them in those necessary arts;—even their own parents, on whom she has devolved this mighty charge, rendered agreeable by the most alluring and powerful of all ties, parental affection. But unless both concur in this grateful task, and continue their joint labours, till they have reared up and planted out their young colony, it must become a prey to every rude invader, and the purpose of nature in the original union of the human pair be defeated. Therefore our structure as well as condition is an evident indication, that the human sexes are destined for a more intimate, for a moral and lasting union. It appears likewise, that the principal end of marriage is not to propagate and nurse up an offspring, but to educate and form minds for the great duties and extensive destinations of life. Society must be supplied from this original nursery with useful members, and its fairest ornaments and supports.

The mind is apt to be dissipated in its views, and acts of friendship and humanity; unless the former be directed to a particular object, and the latter employed in a particular province. When men once indulge to this dissipation, there is no stopping their career; they grow insensible to moral attractions, and, by obstructing or impairing the decent and regular exercise of the tender and generous feelings of the human heart, they in time become unqualified for, or averse to, the forming a moral union of souls, which is the cement of society, and the source of the purest domestic joys. Whereas a rational unpraved love, and its fair companion marriage, collect a man's views, guide his heart to its proper object, and by confining his affection to that object do really enlarge its influence and use. Besides, it is but too evident from the conduct of mankind, that the common ties of humanity are too feeble to engage and interest the passions of the generality in the affairs of society. The connections of neighbourhood, acquaintance, and general intercourse, are too wide a field of action for many; and those of a public or community are so for more, and in which they either care not or know not how to exert themselves. Therefore nature, ever wise and benevolent, by implanting that strong sympathy which reigns between the individuals of each sex, and by urging them to form a particular moral connection, the spring of many domestic endearments, has measured out to each pair a particular sphere of action, proportioned to their views, and adapted to their respective capacities. Besides, by interesting them deeply in the concerns of their own little circle, she has connected them more closely with society, which is composed of particular families, and bound them down to their good behaviour in that particular community to which they belong. This moral connection is marriage, and this sphere of action is a family.

Of the conjugal alliance the following are the natural laws. 1. Mutual fidelity to the marriage-bed. Disloyalty defeats the very end of marriage; dissolves the natural cement of the relation; weakens the moral

tie, the chief strength of which lies in the reciprocity of affection; and, by making the offspring uncertain, diminishes the care and attachment necessary to their education.

2. A conspiracy of counsels and endeavours to promote the common interest of the family, and to educate their common offspring. In order to observe these laws, it is necessary to cultivate, both before and during the married state, the strictest decency and chastity of manners, and a just sense of what becomes their respective characters.

3. The union must be inviolable and for life. The nature of friendship, and particularly of this species of it, the education of their offspring, and the order of society, and of successions which would otherwise be extremely perplexed, do all seem to require it. To preserve this union, and render the matrimonial state more harmonious and comfortable, a mutual esteem and tenderness, a mutual deference and forbearance, a communication of advice, and assistance and authority, are absolutely necessary. If either party keep within their proper departments, there need be no disputes about power or superiority, and there will be none. They have no opposite, no separate interests; and therefore there can be no just ground for opposition of conduct.

From this detail, and the present state of things, in which there is pretty near a parity of numbers of both sexes, it is evident, that polygamy is an unnatural state; and though it should be granted to be more fruitful of children, which however it is not found to be; yet it is by no means so fit for rearing minds; which seems to be as much, if not more, the intention of nature, than the propagation of bodies.

#### *Of Parental Duty.*

THE connection of parents with their children is a natural consequence of the matrimonial connection, and the duties which they owe them result as naturally from that connection. The feeble state of children, subject to so many wants and dangers, requires their incessant care and attention; their ignorant and uncultivated minds demand their continual instruction and culture. Had human creatures come into the world with the full strength of men, and the weakness of reason and vehemence of passions which prevail in children, they would have been too strong or too stubborn to have submitted to the government and instruction of their parents. But, as they were designed for a progression in knowledge and virtue, it was proper that the growth of their bodies should keep pace with that of their minds, lest the purposes of that progression should have been defeated. Among other admirable purposes which this gradual expansion of their outward as well as inward structure serves, this is one, that it affords ample scope to the exercise of many tender and generous affections, which fill up the domestic life with a beautiful variety of duties and enjoyments; and are of course a noble discipline for the heart, and an hardy kind of education for the more honourable and important duties of public life.

The above-mentioned weak and ignorant state of children, seems plainly to invest their parents with such authority

thority and power as is necessary to their support, protection, and education; but that authority and power can be construed to extend no farther than is necessary to answer those ends, and to last no longer than that weakness and ignorance continue; wherefore, the foundation or reason of the authority and power ceasing, they cease of course. Whatever power or authority, then, it may be necessary or lawful for parents to exercise during the non-age of their children, to assume or usurp the same when they have attained the maturity or full exercise of their strength and reason, would be tyrannical and unjust. From hence it is evident, that parents have no right to punish the persons of their children more severely than the nature of their wardship requires; much less to invade their lives, to encroach upon their liberty, or transfer them as their property to any master whatsoever.

The first class of duties which parents owe their children respect their natural life; and these comprehend protection, nurture, provision, introducing them into the world in a manner suitable to their rank and fortune, and the like.

The second order of duties regards the intellectual and moral life of their children, or their education in such arts and accomplishments as are necessary to qualify them for performing the duties they owe to themselves and to others. As this was found to be the principal design of the matrimonial alliance, so the fulfilling that design is the most important and dignified of all the parental duties. In order therefore to fit the child for acting his part wisely and worthily, as a man, as a citizen, and a creature of God, both parents ought to combine their joint wisdom, authority, and power, and each apart to employ those talents which are the peculiar excellency and ornament of their respective sex. The father ought to lay out and superintend their education; the mother to execute and manage the detail of which she is capable. The former should direct the manly exertion of the intellectual and moral powers of his child. His imagination, and the manner of those exertions, are the peculiar province of the latter. The former should advise, protect, command, and by his experience, masculine vigour, and that superior authority which is commonly ascribed to his sex, brace and strengthen his pupil for active life, for gravity, integrity, and firmness in suffering. The business of the latter is to bend and soften her male pupil, by the charms of her conversation, and the softness and decency of her manners, for social life, for politeness of taste, and the elegant decors of and enjoyments of humanity; and to improve and refine the tenderness and modesty of her female pupil, and form her to all those mild domestic virtues, which are the peculiar characteristics and ornaments of her sex.

To conduct the opening minds of their sweet charge through the several periods of their progress; to assist them in each period in throwing out the latent seeds of reason and ingenuity, and in gaining fresh accessions of light and virtue; and at length, with all these advantages, to produce the young adventurers upon the great theatre of human life, to play their several parts in the sight of their friends, of society, and mankind.

### *Herile and Servile Duty.*

In the natural course of human affairs it must necessarily happen, that some of mankind will live in plenty and opulence, and others be reduced to a state of indigence and poverty. The former need the labours of the latter, and the latter the provision and support of the former. This mutual necessity is the foundation of that connection, whether we call it moral or civil, which subsists between masters and servants. He who feeds another has a right to some equivalent, the labour of him whom he maintains, and the fruits of it. And he who labours for another has a right to expect that he should support him. But as the labours of a man of ordinary strength are certainly of greater value than mere food and cloathing; because they would actually produce more, even the maintenance of a family, were the labourer to employ them in his own behalf; therefore he has an undoubted right to rate and dispose of his service for certain wages above mere maintenance; and if he has incautiously disposed of it for the latter only, yet the contract being of the onerous kind, he may equitably claim a supply of that deficiency. If the service be specified, the servant is bound to that only; if not, then he is to be construed as bound only to such services as are consistent with the laws of justice and humanity. By the voluntary servitude to which he subjects himself, he forfeits no rights but such as are necessarily included in that servitude, and is obnoxious to no punishment but such as a voluntary failure in the service may be supposed reasonably to require. The offspring of such servants have a right to that liberty which neither they nor their parents have forfeited.

As to those who, because of some heinous offence, or for some notorious damage, for which they cannot otherwise compensate, are condemned to perpetual service; they do not, on that account, forfeit all the rights of men; but those, the loss of which is necessary to secure society against the like offences for the future, or to repair the damage they have done.

With regard to captives taken in war, it is barbarous and inhuman to make perpetual slaves of them, unless some peculiar and aggravated circumstances of guilt have attended their hostility. The bulk of the subjects of any government engaged in war, may be fairly esteemed innocent enemies; and therefore they have a right to that clemency which is consistent with the common safety of mankind, and the particular security of that society against which they are engaged. Though ordinary captives have a grant of their lives; yet to pay their liberty as an equivalent, is much too high a price. There are other ways of acknowledging or returning the favour, than by surrendering what is far dearer than life itself. To those who, under pretext of the necessities of commerce, drive the unnatural trade of bargaining for human flesh, and consigning their innocent but unfortunate fellow-creatures to eternal servitude and misery, we may address the words of a fine writer; "Let avarice defend it as it will, there is an honest reluctance in humanity against buying and selling and regarding those of our own species as our wealth and possessions."

*Social Duties of the private Kind.*

HITHERTO we have considered only the domestic oeconomic duties, because these are first in the progress of nature. But as man passes beyond the little circle of a family, he forms connections with relations, friends, neighbours, and others; from whence results a new train of duties of the more private social kind, as friendship, chastity, courtesy, good-neighbourhood, charity, forgiveness, hospitality.

Man is admirably formed for particular social attachments and duties. There is a peculiar and strong propensity in his nature to be affected with the sentiments and dispositions of others. Men, like certain musical instruments, are set to each other, so that the vibrations or notes excited in one raise correspondent notes and vibrations in the others. The impulses of pleasure or pain, joy or sorrow, made on one mind, are, by an instantaneous sympathy of nature, communicated in some degree to all; especially when hearts are in unison of kindness; the joy that vibrates in one, communicates to the other also. We may add, that though joy thus imparted swells the harmony; yet grief vibrated to the heart of a friend, and rebounding from thence in sympathetic notes, melts, as it were, and almost dyes away. All the passions, but especially those of the social kind, are contagious; and when the passions of one man mingle with those of another, they increase and multiply prodigiously. There is a most moving eloquence in the human countenance, air, voice, and gesture, wonderfully expressive of the most latent feelings and passions of the soul, which darts them, like a subtle flame, into the hearts of others, and raises correspondent feelings there: friendship, love, good-humour, joy, spread through every feature, and particularly shoot from the eyes their softer and fiercer fires with an irresistible energy. And in like manner, the opposite passions of hatred, enmity, ill humour, melancholy, diffuse a sultry and saddening air over the face, and, flashing from eye to eye, kindle a train of similar passions. By these and other admirable pieces of machinery, men are formed for society and the delightful interchange of friendly sentiment and duties; to increase the happiness of others by participation, and their own by rebound; and to diminish, by dividing, the common stock of their misery.

The first emanations of the social principle beyond the bounds of a family, lead us to form a nearer conjunction of friendship or goodwill with those who are anywise connected with us by blood or domestic alliance. To them our affection does, commonly, exert itself in a greater or less degree, according to the nearness or distance of the relation. And this proportion is admirably suited to the extent of our powers and the indigence of our state; for it is only within those lesser circles of consanguinity or alliance, that the generality of mankind are able to display their abilities or benevolence, and consequently to uphold their connection with society and subserviency to a public interest. Therefore it is our duty to regard these closer connections as the next department to that of a family, in which nature has marked out for us a sphere of activity and usefulness; and to cultivate the

kind affections which are the cement of those endearing alliances.

Frequently, the view of distinguishing moral qualities in some of our acquaintance may give birth to that more noble connection we call friendship, which is far superior to the alliances of consanguinity. For these are of a superficial, and often of a transitory nature; of which, as they hold more of instinct than of reason, we cannot give such a rational account. But friendship derives all its strength and beauty, and the only existence which is durable, from the qualities of the heart, or from virtuous and lovely dispositions. Therefore friendship may be described to be, "The union of two souls, by means of virtue, the common object and cement of their mutual affection." Without virtue, or the supposition of it, friendship is only a mercenary league, an alliance of interest, which must dissolve of course when that interest decays or subsists no longer. It is not so much any particular passion, as a composition of some of the noblest feelings and passions of the mind. Good sense, a just taste and love of virtue, a thorough candor and benignity of heart, or what we usually call a good temper, and a generous sympathy of sentiments and affections, are the necessary ingredients of this virtuous connection. When it is grafted on esteem, strengthened by habit, and mellowed by time, it yields infinite pleasure ever new and ever growing, is a noble support amidst the various trials and vicissitudes of life, and an high seasoning to most of our other enjoyments. To form and cultivate virtuous friendship must be very improving to the temper; as its principal object is virtue, set off with all the allurements of countenance, air, and manners, shining forth in the native graces of manly honest sentiments and affections, and rendered visible as it were to the friendly spectator in a conduct unaffectedly great and good; and as its principal exercises are the very energies of virtue, or its effects and emanations. So that, where-ever this amiable attachment prevails, it will exalt our admiration and attachment to virtue, and, unless impeded in its course by unnatural prejudices, run out into a friendship to the human race. For as no one can merit, and none ought to usurp, the sacred name of friend, who hates mankind; so, whoever truly loves them, possesses the most essential quality of a true friend.

The duties of friendship are, a mutual esteem of each other, unbribed by interest, and independent of it; a generous confidence, as far distant from suspicion as from reserve; an inviolable harmony of sentiments and dispositions, of designs and interests; a fidelity unshaken by the changes of fortune; a constancy unalterable by distance of time or place; a resignation of one's personal interests to those of one's friend; and a reciprocal, unenvious, unreserved exchange of kind offices.—But amidst all the exertions of this moral connection, humane and generous as it is, we must remember that it operates within a narrow sphere, and its immediate operations respect only the individual; and therefore particular impulses must still be subordinate to a more public interest, or be always directed and controuled by the more extensive connections of our nature.

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sex, in whom beauty or agreeableness of person and external gracefulness of manners conspire to express and heighten the moral charm of a tender honest heart, and sweet, ingenuous, modest temper, lighted up by good sense, it generally grows into a more soft and endearing attachment. When this attachment is improved by a growing acquaintance with the worth of its object, is conducted by discretion, and issues at length, as it ought to do, in the moral connection of marriage, it becomes the source of many amiable duties, of a communication of passions and interests, of the most refined decencies, and of a thousand nameless deep-felt joys of reciprocal tenderness and love, flowing from every look, word, and action. Here friendship acts with double energy, and the natural confpires with the moral charm to strengthen and secure the love of virtue. As the delicate nature of female honour and decorum, and the inexpressible grace of a chaste and modest behaviour, are the surest and indeed the only means of kindling at first, and ever after of keeping alive this tender and elegant flame, and of accomplishing the excellent ends designed by it; to attempt by fraud to violate one, or, under pretence of passion, fully and corrupt the other, and, by so doing, to expose the too often credulous and unguarded object, with a wanton cruelty, to the hatred of her own sex, and the scorn of ours, and to the lowest infamy of both, is a conduct not only base and criminal, but inconsistent with that truly rational and refined enjoyment, the spirit and quintessence of which is derived from the bashful and sacred charms of virtue kept untainted, and therefore ever alluring to the lover's heart.

Courtesy, good-neighbourhood, affability, and the like duties which are founded on our private social connections, are no less necessary and obligatory to creatures united in society, and supporting and supported by each other in a chain of mutual want and dependence. They do not consist in a smooth address, an artificial or obsequious air, fawning adulation, or a polite servility of manners; but in a just and modest sense of our own dignity and that of others, and of the reverence due to mankind, especially to those who hold the higher links of the social chain; in a discreet and manly accommodation of ourselves to the the foibles and humours of others; in a strict observance of the rules of decorum and civility; but above all in a frank obliging carriage, and generous interchange of good deeds rather than words. Such a conduct is of great use and advantage, as it is an excellent security against injury, and the best claim and recommendation to the esteem, civility, and universal respect of mankind. This inferior order of virtues unites the particular members of society more closely, and form the lesser pillars of the civil fabric; which, in many instances, supply the unavoidable defects of laws, and maintain the harmony and decorum of social intercourse, where the more important and essential lines of virtue are wanting.

Charity and forgiveness are truly amiable and useful duties of the social kind. There is a twofold distinction of rights commonly taken notice of by moral writers, *viz.* perfect and imperfect. To fulfil the former, is necessary to the being and support of society; to fulfil the latter, is a duty equally sacred and obligatory, and tends

to the improvement and prosperity of society: but as the violation of them is not equally prejudicial to the public good, the fulfilling them is not subjected to the cognizance of laws, but left to the candor, humanity, and gratitude of individuals. And by this means ample scope is given to exercise all the generosity, and display the genuine merit and lustre of virtue. Thus the wants and misfortunes of others call for our charitable assistance and seasonable supplies: and the good man, unconstrained by law, and uncontrolled by human authority, will cheerfully acknowledge and generously satisfy this mournful and moving claim; a claim supported by the sanction of heaven, of whose bounties he is honoured to be the grateful trustee. If his own perfect rights are invaded by the injustice of others, he will not therefore reject their imperfect right to pity and forgiveness, unless his grant of these should be inconsistent with the more extensive rights of society or the public good. In that case he will have recourse to public justice and the laws; and even then he will prosecute the injury with no unnecessary severity, but rather with mildness and humanity. When the injury is merely personal, and of such a nature as to admit of alleviations, and the forgiveness of which would be attended with no worse consequences, especially of a public kind, the good man will generously forgive his offending brother. And it is his duty to do so, and not to take private revenge, or retaliate evil for evil. For though resentment of injury is a natural passion, and implanted, as was observed above, for wise and good ends; yet, considering the manifold partialities which most men have for themselves, was every one to act as judge in his own cause, and to execute the sentence dictated by his own resentment, it is but too evident that mankind would pass all bounds in their fury, and the last sufferer be provoked in his turn to make full reprisals. So that evil, thus encountering with evil, would produce one continued series of violence and misery, and render society intolerable, if not impracticable. Therefore, where the security of the individual, or good of the public, does not require a proportionable retaliation, it is agreeable to the general law of benevolence, and to the particular end of the passion (which is to prevent injury, and the misery occasioned by it) to forgive personal injuries, or not to return evil for evil. This duty is one of the noble refinements which Christianity has made upon the general maxims and practice of mankind, and enforced with a peculiar strength and beauty by sanctions no less alluring than awful. And indeed the practice of it is generally its own reward; by expelling from the mind the most dreadful intruders upon its repose, those rancorous passions which are begot and nursed by resentment; and by disarming and even subduing every enemy one has, except such as have nothing left of men but the outward form.

The most enlarged and humane connection of the private kind, seems to be the hospitable alliance from which flow the amiable and disinterested duties we owe to strangers. If the exercise of passions of the most private and instinctive kind is beheld with moral approbation and delight, how lovely and venerable must those appear, which result from a calm philanthropy, are founded in the common rights and connections of society, and embrace men,

not of a particular sect, party, or nation, but all in general without distinction, and without any of the little partialities of self-love!

*Social Duties of the COMMERCIAL Kind.*

THE next order of connections are those which arise from the wants and weakness of mankind, and from the various circumstances in which their different situations place them. These we may call *commercial connections*; and the duties which result from them *commercial duties*, as justice, fair-dealing, sincerity, fidelity to compacts, and the like.

Though nature is perfect in all her works, yet she has observed a manifest and eminent distinction among them. To all such as lie beyond the reach of human skill and power, and are properly of her own department, she has given the finishing hand. These man may design after and imitate; but he can neither rival them, nor add to their beauty or perfection: such are the forms and structure of vegetables, animals, and many of their productions. There are others of her works which she has of design left unfinished, as it were, in order to exercise the ingenuity and power of man. She has presented to him a rich profusion of materials of every kind for his conveniency and use; but they are rude and unpolished, or not to be come at without art and labour. These therefore he must apply, in order to adapt them to his use, and to enjoy them in perfection. Thus nature has given him an infinite variety of herbs, grain, fossils, minerals, wood, water, earth, and a thousand other crude materials to supply his numerous wants. But he must sow, plant, dig, refine, polish, build, and, in short, manufacture the various produce of nature, in order to obtain even the necessaries, and much more the conveniencies and elegancies of life. These, then, are the price of his labour and industry; and, without that, nature will sell him nothing. But as the wants of mankind are many, and the single strength of individuals small, they could hardly find the necessaries, and much less the conveniencies of life, without uniting their ingenuity and strength in acquiring these, and without a mutual intercourse of good offices. Some men are better formed for some kinds of ingenuity and labour, and others for other kinds; and different soils and climates are enriched with different productions; so that men, by exchanging the produce of their respective labours, and supplying the wants of one country with the superfluities of another, do, in effect, diminish the labours of each, and increase the abundance of all. This is the foundation of all commerce, or exchange of commodities and goods one with another; in order to facilitate which, men have contrived different species of coin or money, as a common standard by which to estimate the comparative values of their respective goods. But, to render commerce sure and effectual, justice, fair-dealing, sincerity, and fidelity to compacts are absolutely necessary.

Justice, or fair dealing, or, in other words, a disposition to treat others as we would be treated by them, is a virtue of the first importance, and inseparable from the virtuous character. It is the cement of society, or that pervading spirit which connects its members, inspires its

various relations, and maintains the order and subordination of each part to the whole. Without it, society would become a den of thieves and banditti, hating and hated, devouring and devoured, by one another.

Sincerity or veracity in our words and actions is another virtue or duty of great importance to society, being one of the great bands of mutual intercourse, and the foundation of mutual trust. Without it, society would be the dominion of mistrust, jealousy and fraud, and conversation a traffick of lies and dissimulation. It includes in it a conformity of our words with our sentiments, a correspondence between our actions and dispositions, a strict regard to truth, and an irreconcilable abhorrence of falsehood. It does not indeed require that we expose our sentiments indiscreetly, or tell all the truth in every case; but certainly it does not and cannot admit the least violation of truth, or contradiction to our sentiments. For if these bounds are once passed, no possible limit can be assigned where the violation shall stop; and no pretence of private or public good can possibly counterbalance the ill consequences of such a violation.

Fidelity to promises, compacts and engagements, is likewise a duty of such importance to the security of commerce and interchange of benevolence among mankind, that society would soon grow intolerable without the strict observance of it. Hobbes, and others who follow the same track, have taken a wonderful deal of pains to puzzle this subject, and to make all the virtues of this sort merely artificial, and not at all obligatory, antecedent to human conventions. No doubt, compacts suppose people who make them, and promises suppose persons to whom they are made; and therefore both suppose some society more or less between those who enter into these mutual engagements. But is not a compact or promise binding, till men have agreed that they shall be binding? Or are they only binding because it is our interest to be bound by them, or to fulfill them? Do not we highly approve the man who fulfills them, even though they should prove to be against his interest? And do not we condemn him as a knave, who violates them on that account? A promise is a voluntary declaration, by words, or by an action equally significant, of our resolution to do something in behalf of another, or for his service. When a promise is made, the person who makes it is by all supposed under an obligation to perform it; and he to whom it is made may demand the performance as his right. That perception of obligation is a simple idea, and is on the same footing as our other moral perceptions; which may be described by instances, but cannot be defined. Whether we have a perception of such obligation quite distinct from the interest, either public or private, that may accompany the fulfillment of it, must be referred to the conscience of every individual. And, whether the mere sense of that obligation, apart from its concomitants, is not a sufficient inducement or motive to keep one's promise, without having recourse to any selfish principle of our nature, must be likewise appealed to the conscience of every honest man. Fair dealing and fidelity to compacts require that we take no advantage of the ignorance, passion, or incapacity of others, from whatever cause that incapacity arises;—that we be explicit and candid in making bargains, just and faithful

faithful in fulfilling our part of them. And if the other party violates his engagements, redress is to be sought from the laws, or from those who are intrusted with the execution of them. In fine, the commercial virtues and duties require that we not only do not invade, but maintain the rights of others;—that we be fair and impartial in transferring, bartering, or exchanging property, whether in goods or service;—and be inviolably faithful to our word and our engagements, where the matter of them is not criminal, and where they are not extorted by force.

*Social Duties of the POLITICAL Kind.*

WE are now arrived at the last and highest order of duties respecting society, which result from the exercise of the most generous and heroic affections, and are founded on our most elegant connections.

The social principle in man is of such an expansive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood; it spreads into wider systems, and draws men into larger confederacies, communities, and commonwealths.—It is in these only that the higher powers of our nature attain the highest improvement and perfection of which they are capable. These principles hardly find objects in the solitary state of nature. There the principle of action rises no higher at farthest than natural affection towards one's offspring. There personal or family-wants entirely engross the creature's attention and labour, and allow no leisure, or, if they did, no exercise for views and affections of a more enlarged kind. In solitude all are employed in the same way, in providing for the animal life. And even after their utmost labour and care, single and unaided by the industry of others, they find but a sorry supply of their wants, and a feeble precarious security against dangers from wild beasts, from inclement skies and seasons, from the mistakes or petulant passions of their fellow-creatures, from their preference of themselves to their neighbours, and from all the little exorbitances of self-love. But in society, the mutual aids which men give and receive shorten the labours of each, and the combined strength and reason of individuals give security and protection to the whole body. There is both a variety and subordination of genius among mankind. Some are formed to lead and direct others; to contrive plans of happiness for individuals, and of government for communities; to take in a public interest; to invent laws and arts, and superintend their execution; and, in short, to refine and civilize human life. Others, who have not such good heads, may have as honest hearts, a truly public spirit, love of liberty, hatred of corruption and tyranny, a generous submission to laws, order, and public institutions, and an extensive philanthropy. And others, who have none of those capacities either of heart, or head, may be well formed for manual exercises and bodily labour. The former of these principles have no scope in solitude, where a man's thoughts and concerns do all either center in himself, or extend no farther than a family; into which little circle all the duty and virtue of the solitary mortal is crowded. But society finds proper objects and exercises for every genius, and the noblest objects and exercises for the noblest geniuses,

and for the highest principles in the human constitution: particularly for that warmest and most divine passion, which God hath kindled in our bosoms, the inclination of doing good, and reverencing our nature; which may find here both employment, and the most exquisite satisfaction. In society a man has not only more leisure, but better opportunities of applying his talents with much greater perfection and success, especially as he is furnished with the joint advice and assistance of his fellow-creatures, who are now more closely united one with the other, and sustain a common relation to the same moral system, or community. This then is an object proportioned to his most enlarged social affections, and in serving it he finds scope for the exercise and refinement of his highest intellectual and moral powers. Therefore society, or a state of civil government, rests on these two principal pillars; "that in it we find security against those evils which are unavoidable in solitude; and obtain those goods, some of which cannot be obtained at all, and others not so well, in that state, where men depend solely on their individual sagacity and industry."

From this short detail it appears that man is a social creature, and formed for a social state; and that society, being adapted to the higher principles and destinations of his nature, must, of necessity, be his natural state.

The duties suited to that state, and resulting from those principles and destinations, or, in other words, from our social passions and social connections, or relation to a public system, are love of our country, resignation and obedience to the laws, public spirit, love of liberty, sacrifice of life and all to the public, and the like.

Love of our country is one of the noblest passions that can warm and animate the human breast. It includes all the limited and particular affections to our parents, children, friends, neighbours, fellow-citizens, countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them inroach on those sacred and first regards we owe to the great public to which we belong. Were we solitary creatures, detached from the rest of mankind, and without any capacity of comprehending a public interest, or without affections leading us to desire and pursue it, it would not be our duty to mind it, nor criminal to neglect it. But, as we are parts of the public system, and are not only capable of taking in large views of its interests, but by the strongest affections connected with it, and prompted to take a share of its concerns, we are under the most sacred ties to prosecute its security and welfare with the utmost ardor, especially in times of public trial. This love of our country, does not import an attachment to any particular soil, climate, or spot of earth, where perhaps we first drew our breath, though those natural ideas are often associated with the moral ones, and, like external signs or symbols, help to ascertain and bind them; but it imports an affection to that moral system, or community, which is governed by the same laws and magistrates, and whose several parts are variously connected one with the other, and all united upon the bottom of a common interest. Perhaps indeed every member of the community cannot comprehend so large an object, especially if it extends through large  
provinces,

provinces, and over vast tracts of land; and still less can he form such an idea, if there is no public, *i. e.* if all are subjected to the caprice and unlimited will of one man: but the preference the generality shew to their native country, the concern and longing after it which they express when they have been long absent from it, the labours they undertake and sufferings they endure to save or serve it, and the peculiar attachment they have to their countrymen, evidently demonstrate that the passion is natural, and never fails to exert itself, when it is fairly disengaged from foreign clogs, and is directed to its proper object. Where-ever it prevails in its genuine vigour and extent, it swallows up all sordid and selfish regards; it conquers the love of ease, power, pleasure and wealth; nay, when the amiable partialities of friendship, gratitude, private affection, or regard to a family come in competition with it, it will teach us bravely to sacrifice all, in order to maintain the rights and promote or defend the honour and happiness of our country.

Resignation and obedience to the laws and orders of the society to which we belong, are political duties necessary to its very being and security, without which it must soon degenerate into a state of licence and anarchy. The welfare, nay, the nature of civil society, requires that there should be a subordination of orders or diversity of ranks and conditions in it;—that certain men, or orders of men, be appointed to superintend and manage such affairs as concern the public safety and happiness;—that all have their particular provinces assigned them;—that such a subordination be settled among them, as none of them may interfere with another;—and finally, that certain rules or common measures of action be agreed on, by which each is to discharge his respective duty to govern or be governed, and all may concur in securing the order and promoting the felicity of the whole political body. Those rules of action are the laws of the community; and those different orders are the several officers, or magistrates, appointed by the public to explain them, and superintend or assist in their execution. In consequence of this settlement of things, it is the duty of each individual to obey the laws enacted, to submit to the executors of them with all due deference and homage according to their respective ranks and dignity, as to the keepers of the public peace, and the guardians of public liberty; to maintain his own rank, and perform the functions of his own station with diligence, fidelity, and incorruption. The superiority of the higher orders, or the authority with which the state has invested them, entitle them, especially if they employ their authority well, to the obedience and submission of the lower, and to a proportionable honour and respect from all. The subordination of the lower ranks claims protection, defence, and security from the higher. And the laws, being superior to all, require the obedience and submission of all; being the last resort, beyond which there is no decision or appeal.

Public spirit, heroic zeal, love of liberty, and the other political duties, do, above all others, recommend those who practise them to the admiration and homage of mankind; because, as they are the offspring of the noblest minds, so are they the parents of the greatest blessings to society. Yet, exalted as they are, it is only in equal

and free governments where they can be exercised and have their due effect: for there only does a true public prevail, and there only is the public good made the standard of the civil constitution. As the end of society is the common interest and welfare of the people associated, this end must of necessity be the supreme law or common standard by which the particular rules of action of the several members of the society towards each other are to be regulated. But a common interest can be no other than that which is the result of the common reason, or common feelings of all. Private men, or a particular order of men, have interests and feelings peculiar to themselves, and of which they may be good judges: but these may be separate from, and often contrary to the interests and feelings of the rest of the society; and therefore they can have no right to make, much less to impose, laws on their fellow-citizens, inconsistent with, or opposite to, those interests and those feelings. Therefore a society, a government, a real public, truly worthy the name; and not a confederacy of banditti, a clan of lawless savages, or a band of slaves under the whip of a master; must be such a one as consists of freemen, chusing or consenting to laws themselves, or, since it often happens that they cannot assemble and act in a collective body, delegating a sufficient number of representatives, *i. e.* such a number as shall most fully comprehend, and most equally represent, their common feelings and common interests, to digest and vote laws for the conduct and controul of the whole body the most agreeable to those common feelings and common interests.

A society thus constituted by common reason, and formed on the plan of a common interest, becomes immediately an object of public attention, public veneration, public obedience, a public and inviolable attachment, which ought neither to be seduced by bribes, nor awed by terrors; an object, in fine, of all those extensive and important duties which arise from so glorious a confederacy. To watch over such a system; to contribute all he can to promote its good by his reason, his ingenuity, his strength, and every other ability, whether natural or acquired; to resist, and to the utmost of his power defeat, every incroachment upon it, whether carried on by secret corruption, or open violence; and to sacrifice his ease, his wealth, his power, nay life itself, and, what is dearer still, his family and friends, to defend or save it; is the duty, the honour, the interest, and the happiness of every citizen; it will make him venerable and beloved while he lives, be lamented and honoured if he falls in so glorious a cause, and transmit his name with immortal renown to the latest posterity.

As the people are the fountain of power and authority, the original seat of majesty, the authors of laws, and the creators of officers to execute them; if they shall find the power they have conferred abused by their trustees, their majesty violated by tyranny or by usurpation, their authority prostituted to support violence or screen corruption, the laws grown pernicious through accidents unforeseen or unavoidable, or rendered ineffectual thro' the infidelity and corruption of the executors of them; then it is their right, and what is their right is their du-

ty, to resume that delegated power, and call their trustees to an account; to resist the usurpation, and extirpate the tyranny; to restore their sullied majesty and prostituted authority; to suspend, alter, or abrogate those laws, and punish their unfaithful and corrupt officers. Nor is it the duty only of the united body, but every member of it ought, according to his respective rank, power, and weight in the community, to concur in advancing and supporting those glorious designs.

*Duty to God.*

Of all the relations which the human mind sustains, that which subsists between the Creator and his creatures, the Supreme Lawgiver and his subjects, is the highest and the best. This relation arises from the nature of a creature in general, and the constitution of the human mind in particular; the noblest powers and affections of which point to an Universal Mind, and would be imperfect and abortive without such a direction. How lame then must that system of morals be, which leaves a Deity out of the question! How disconsolate, and how destitute of its firmest support!

It does not appear, from any true history or experience of the mind's progress, that any man, by any formal deduction of his discursive powers, ever reasoned himself into the belief a God. Whether such a belief is only some natural anticipation of soul; or is derived from father to son, and from one man to another, in the way of tradition; or is suggested to us in consequence of an immutable law of our nature, on beholding the august aspect and beautiful order of the universe; we will not pretend to determine. What seems most agreeable to experience is, that a sense of its beauty and grandeur, and the admirable fitness of one thing to another in its vast apparatus, leads the mind necessarily and unavoidably to a perception of design, or of a designing cause, the origin of all, by a progress as simple and natural as that by which a beautiful picture or a fine building suggests to us the idea of an excellent artist. For it seems to hold universally true, that where-ever we discern a tendency or co-operation of things towards a certain end, or producing a common effect; there, by a necessary law of association, we apprehend design, a designing energy or cause: *See METAPHYSICS.* As we conceive this Being or First Cause before all, above all, and greater than all, we naturally, and without reasoning, ascribe to him every kind of perfection, wisdom, power, and goodness without bounds, existing through all time, and pervading all space. We apply to him those glorious epithets of our Creator, Preserver, Benefactor, the Supreme Lord and Law-giver of the whole society of rational intelligent creatures. Not only the imperfections and wants of our being and condition, but some of the noblest instincts and affections of our minds, connect us with this great and universal nature. The mind, in its progress from object to object, from one character and prospect of beauty to another, finds some blemish or deficiency in each, and soon exhausts or grows weary and dissatisfied with its subject: it sees no character of excellency among men, equal to that pitch of esteem which it is capable of exerting; no object within the compass of human things ad-

equate to the strength of its affection. Nor can it stop any where in this self-expansive progress, or find repose after its highest flights, till it arrives at a Being of unbounded greatness and worth, on whom it may employ its sublimest powers without exhausting the subject, and give scope to the utmost force and fullness of its love without satiety or disgust. So that the nature of this Being corresponds to the nature of man; nor can his intelligent and moral powers obtain their entire end, but on the supposition of such a Being, and without a real sympathy and communication with him. The native propensity of the mind to reverence whatever is great and wonderful in nature, finds a proper object of homage in him who spread out the heavens and the earth, and who sustains and governs the whole of things. The admiration of beauty, the love of order, and the complacency we feel in goodness, must rise to the highest pitch, and attain the full vigour and joy of their operations, when they unite in Him who is the sum and source of all perfection.

It is evident, from the slightest survey of morals, that how punctual soever one may be in performing the duties which result from our relations to mankind; yet to be quite deficient in performing those which arise from our relation to the Almighty, must argue a strange perversion of reason or depravity of heart. If imperfect degrees of worth attract our veneration, and if the want of it would imply an insensibility, or, which is worse, an aversion to merit; what lameness of affection, and immorality of character, must it be, to be unaffected with, and much more to be ill-affected to, a Being of superlative worth! To love society, or particular members of it, and yet to have no sense of our connection with its Head, no affection to our common Parent and Benefactor; to be concerned about the approbation or censure of our fellow-creatures, and yet to feel nothing of this kind towards Him who sees and weighs our actions with unerring wisdom and justice, and can fully reward or punish them; betrays equal madness and partiality of mind. It is plain, therefore, beyond all doubt, that some regards are due to the great Father of all, in whom every lovely and adorable quality combines to inspire veneration and homage.

As it has been observed already, that our affections depend on our opinions of their objects, and generally keep pace with them, it must be of the highest importance, and seems to be among the first duties we owe to the Author of our being, "to form the least imperfect, since we cannot form perfect conceptions of his character and administration." For such conceptions, thoroughly imbibed, will render our religion rational, and our dispositions refined. If our opinions are diminutive and distorted, our religion will be superstitious, and our temper abject. The foundation, then, of all true religion is a rational faith. And of a rational faith these seem to be the chief articles: To believe, "that an infinite all-perfect Mind exists, who has no opposite nor any separate interest from that of his creatures:—that he superintends and governs all creatures and things:—that his goodness extends to all his creatures, in different degrees indeed, according to their respective natures, but without any partiality or envy:—that he does every thing for the best,

or in a subserviency to the perfection and happiness of the whole ;—particularly, that he directs and governs the affairs of men,—inspects their actions,—distinguishes the good from the bad,—loves and befriends the former,—is displeased with and pities the latter in this world,—and will, according to their respective deserts, reward the one, and punish the other in the next :—that, in fine, he is always carrying on a scheme of virtue and happiness through an unlimited duration,—and is ever guiding the universe through its successive stages and periods, to higher degrees of perfection and felicity.” This is true theism, the glorious scheme of divine faith ; a scheme exhibited in all the works of God, and executed through his whole administration.

This faith, well-founded and deeply felt, is nearly connected with a true moral taste, and hath a powerful efficacy on the temper and manners of the thief. He who admires goodness in others, and delights in the practice of it, must be conscious of a reigning order within, a rectitude and candor of heart which disposes him to entertain favourable apprehensions of men, and, from an impartial survey of things, to presume that good order and good meaning prevail in the universe ; and if good meaning and good order, then an ordering and intending Mind, who is no enemy, no tyrant to his creatures, but a friend, a benefactor, an indulgent sovereign.—On the other hand, a bad man, having nothing goodly or generous to contemplate within, no right intentions, nor honesty of heart, suspects every person and every thing ; and beholding nature through the gloom of a selfish and guilty mind, is either averse to the belief of a reigning order ; or, if he cannot suppress the unconquerable anticipations of a governing mind, he is prone to tarnish the beauty of nature, and to impute malevolence, or blindness and impotence at least, to the Sovereign Ruler. He turns the universe into a forlorn and horrid waste ; and transfers his own character to the Deity, by ascribing to him that uncommunicative grandeur, that arbitrary or revengeful spirit which he affects or admires in himself. As such a temper of mind naturally leads to atheism, or to a superstition full as bad ; therefore, as far as that temper depends on the unhappy creature in whom it prevails, the propensity to atheism or superstition consequent thereto must be immoral. Farther, if it be true that the belief or sense of a Deity is natural to the mind, and the evidence of his existence reflected from his works so full as to strike even the most superficial observer with conviction ; then the supplanting or corrupting that sense, or the want of due attention to that evidence, and, in consequence of both, a supine ignorance or affected unbelief of a Deity, must argue a bad temper, or an immoral turn of mind. In the case of invincible ignorance, or a very bad education, though nothing can be concluded directly against the character, yet whenever ill passions and habits pervert the judgment, and by perverting the judgment terminate in atheism, then the case becomes plainly criminal.

But let casuists determine this as they will, a true faith in the divine character and administration is generally the consequence of a virtuous state of mind. The

man who is truly and habitually good, feels the love of order, of beauty, and goodness, in the strongest degree ; and therefore cannot be insensible to those emanations of them which appear in all the works of God, nor help loving their Supreme Source and Model. He cannot but think, that He who has poured such beauty and goodness over all his works, must Himself delight in beauty and goodness, and what He delights in must be both amiable and happy. Some indeed there are, and it is pity there should be any such, who, through the unhappy influence of a wrong education, have entertained dark and unfriendly thoughts of a Deity and his administration, though otherwise of a virtuous temper themselves. However, it must be acknowledged, that such sentiments have, for the most part, a bad effect on the temper ; and when they have not, it is because the undepraved affections of an honest heart are more powerful in their operation, than the speculative opinions of an ill-formed head.

But where-ever right conceptions of the Deity and his providence prevail, when he is considered as the inexhausted source of light and love and joy, as acting in the joint character of a father and governor, imparting an endless variety of capacities to his creatures, and supplying them with every thing necessary to their full completion and happiness, what veneration and gratitude must such conceptions thoroughly believed excite in the mind ! How natural and delightful must it be to one whose heart is open to the perception of truth, and of every thing fair, great, and wonderful in nature, to contemplate and adore Him, who is the First Fair, the First Great, and First Wonderful ; in whom wisdom, power and goodness dwell vitally, essentially, originally, and act in perfect concert ! What grandeur is here to fill the most enlarged capacity, what beauty to engage the most ardent love, what a mass of wonders in such exuberance of perfection, to astonish and delight the human mind through an unfailling duration !

If the Deity is considered as our supreme guardian and benefactor, as the father of mercies, who loves his creatures with infinite tenderness, and in a particular manner all good men, nay, who delights in goodness even in its most imperfect degrees ; what resignation, what dependence, what generous confidence, what hope in God and his all-wise providence, must arise in the soul that is possessed of such amiable views of him ! All those exercises of piety, and above all a superlative esteem and love, are directed to God as to their natural, their ultimate, and indeed their only adequate object : and though the immense obligations we have received from him may excite in us more lively feelings of divine goodness than a general and abstracted contemplation of it ; yet the affections of gratitude and love are themselves of the generous disinterested kind, not the result of self interest, or views of reward. A perfect character, in which we always suppose infinite goodness, guided by unerring wisdom, and supported by almighty power, is the proper object of perfect love ; and though that character sustains to us the relation of a benefactor, yet the mind, deeply struck with that perfection, is quite lost amidst such a blaze of beau-

ty, and grows as it were insensible to those minuter irradiations of it upon itself. To talk, therefore, of a mercenary love of God, or which has fear for its principal ingredient, is equally impious and absurd. If we do not love the loveliest object in the universe for his own sake, no prospect of good or fear of ill can ever bribe our esteem, or captivate our love. These affections are too noble to be bought or sold, or bartered in the way of gain; worth, or merit, as their object, and their reward is something similar in kind. Whoever indulges such sentiments and affections towards the Deity, must be confirmed in the love of virtue, in a desire to imitate its all-perfect Pattern, and in a cheerful security that all his great concerns, those of his friends and of the universe, shall be absolutely safe under the conduct of unerring wisdom and unbounded goodness. It is in his care and providence alone that the good man, who is anxious for the happiness of all, finds perfect serenity, a serenity neither ruffled by partial ill, nor soured by private disappointment.

When we consider the unstained purity and absolute perfection of the divine nature, and reflect withal on the imperfection and various blemishes of our own, we must sink, or be convinced we ought to sink, into the deepest humility and prostration of soul before Him who is so wonderfully great and holy. When, farther, we call to mind what low and languid feelings we have of the Divine Presence and Majesty; what insensibility of his fatherly and universal goodness, nay, what ungrateful returns we have made to it; how far we come short of the perfection of his law, and the dignity of our own nature; how much we have indulged to the selfish passions, and how little to the benevolent ones; we must be conscious that it is our duty to repent of a temper and conduct so unworthy our nature, and unbecoming our obligations to its Author, and to resolve and endeavour to act a wiser and better part for the future.

Nevertheless, from the character which his works exhibit of him, from those delays or alleviations of punishment which offenders often experience, and from the merciful tenour of his administration in many other instances, the sincere penitent may entertain good hopes that his Parent and Judge will not be strict to mark iniquity, but will be propitious and favourable to him, if he honestly endeavours to avoid his former practices, and subdue his former habits, and to live in a greater conformity to the divine will for the future. If any doubts or fears should still remain, how far it may be consistent with the rectitude and equity of the divine government to let his iniquities pass unpunished; yet he cannot think it unfit to his paternal clemency and wisdom to contrive a method of retrieving the penitent offender, that shall unite and reconcile the majesty and mercy of his government. If reason cannot of itself suggest such a scheme, it gives at least some ground to expect it. But though natural religion cannot let in more light and assurance on so interesting a subject, yet it will teach the humble thief to wait with great submission for any farther intimations it may please the Supreme Governor to give of his will; examine with candour and impartiality whatever evidence shall be proposed to him of a divine revelation, whether that evidence is natural or supernatural; to embrace it with veneration

and cheerfulness, if the evidence is clear and convincing; and finally, if it bring to light any new relations or connections, natural religion will persuade its sincere votary faithfully to comply with the obligations, and perform the duties which result from those relations and connections. — This is theism, piety, the completion of morality!

We must further observe, that all those affections which we supposed to regard the Deity as their immediate and primary object, are vital energies of the soul, and consequently exert themselves into act; and like all its other energies, gain strength or greater activity by that exertion. It is therefore our duty, as well as highest interest, often, at stated times, and by decent and solemn acts, to contemplate and adore the great Original of our existence, the Parent of all beauty, and of all good; to express our veneration and love, by an awful and devout recognition of his perfections; and to evidence our gratitude, by celebrating his goodness, and thankfully acknowledging all his benefits. It is likewise our duty, by proper exercises of sorrow and humiliation, to confess our ingratitude and folly; to signify our dependence on God, and our confidence in his goodness, by imploring his blessing and gracious concurrence in assisting the weakness, and curing the corruptions of our nature; and finally, to testify our sense of his authority, and our faith in his government, by devoting ourselves to do his will, and resigning ourselves to his disposal. These duties are not therefore obligatory, because the Deity needs or can be profited by them; but as they are apparently decent and moral; suitable to the relations he sustains of our Creator, Benefactor, Law-giver and Judge; expressive of our state and obligations; and improving to our tempers, by making us more rational, social, godlike, and consequently more happy.

We have now considered internal piety, or the worship of the mind, that which is in spirit and in truth; we shall conclude the section with a short account of that which is external. External worship is founded on the same principles as internal, and of a strict moral obligation. It is either private or public. Devotion, that is inward, or purely intellectual, is too spiritual and abstracted an operation for the bulk of mankind. The operations of their minds, such especially as are employed on the most sublime immaterial objects, must be assisted by their outward organs, or by some help from the imagination, otherwise they will be soon dissipated by sensible impressions, or grow tiresome if too long continued. Ideas are such fleeting things that they must be fixed, and so subtle that they must be expressed and delineated, as it were, by sensible marks and images; otherwise we cannot attend at them, nor be much affected to them. Therefore verbal adoration, prayer, praise, thanksgiving, and confession, are admirable aids to inward devotion, fix our attention, compose and enliven our thoughts, impress us more deeply with a sense of the awful presence in which we are, and, by a natural and mechanical sort of influence, tend to heighten those devout feelings and affections which we ought to entertain, and after this manner reduce into formal and explicit act.

This holds true in an higher degree in the case of public worship, where the presence of our fellow-creatures, and the powerful contagion of the social affections, conspire to kindle and spread the devout flame with greater energy.

energy. To conclude: As God is the parent and head of the social system; as he has formed us for a social state; as by one we find the best security against the ills of life, and in the other enjoy its greatest comforts; and as, by means of both, our nature attains its highest improvement and perfection; and moreover, as there are public blessings and crimes in which we all share in some degree, and public wants and dangers to which all are exposed; it is therefore evident, that the various and solemn offices of public religion, are duties of indispensable moral obligation, among the best cements of society, the firmest prop of government, and the fairest ornament of both.

*Of Practical Ethics, or the Culture of the Mind.*

We have now gone through a particular detail of the several duties we owe to ourselves, to society, and to God. In considering the first order of duties, we just touched on the methods of acquiring the different kinds of goods which we are led by nature to pursue; only we left the consideration of the method of acquiring the moral goods of the mind to a section by itself, because of its singular importance. This section, then, will contain a brief enumeration of the arts of acquiring virtuous habits, and of eradicating vitious ones, as far as is consistent with the brevity of such a work; a subject of the utmost difficulty as well as importance in morals: to which, nevertheless, the least attention has been generally given by moral writers, especially those of a modern date. This will properly follow a detail of duty, as it will direct us to such means or helps as are most necessary and conducive to the practice of it.

In the first part of this inquiry we traced the order in which the passions shoot up in the different periods of human life. That order is not accidental, nor dependent on the caprice of men, or the influence of custom and education; but arises from the original constitution and laws of our nature; of which this is one, *viz.* "That sensible objects make the first and strongest impressions on the mind." These, by means of our outward organs, being conveyed to the mind, become objects of its attention on which it reflects when the outward objects are no longer present, or, in other words, when the impressions upon the outward organs cease. These objects of the mind's reflection are called *ideas* or *images*. Towards these, by another law of our nature, we are not altogether indifferent; but correspondent movements of desire or aversion, love or hatred, arise, according as the objects of which they are images or copies made an agreeable or disagreeable impression on our organs. Those ideas and affections which we experience in the first period of life, we refer to the body, or to sense; and the taste which is formed towards them, we call a *sensible*, or a *merely natural* taste; and the objects corresponding to them we in general call *good* or *pleasant*.

But, as the mind moves forward in its course, it extends its views, and receives a new and more complex set of ideas, in which it observes uniformity, variety, similitude, symmetry of parts, reference to an end, novelty, grandeur. These compose a vast train and diversity of ima-

gery, which the mind compounds, divides, and moulds into a thousand forms, in the absence of those objects which first introduced it. And this more complicated imagery suggests a new train of desires and affections, full as sprightly and engaging as any which have yet appeared. This whole class of perceptions or impressions is referred to the imagination, and forms an higher taste than the sensible, and which has an immediate and mighty influence on the finer passions of our nature, and is commonly termed a *fine taste*.

The objects which correspond to this taste we use to call beautiful, harmonious, great, or wonderful, or, in general, by the name of *beauty*.

The mind still pushing onwards, and increasing its stock of ideas, ascends from those to an higher species of objects, *viz.* the order and mutual relations of minds to each other, their reciprocal affections, characters, actions, and various aspects. In these it discovers a beauty, a grandeur, a decorum more interesting and alluring than in any of the former kinds. These objects, or the images of them passing in review before the mind, do, by a necessary law of our nature, call forth another and nobler set of affections, as admiration, esteem, love, honour, gratitude, benevolence, and others of the like tribe. This class of perceptions, and their correspondent affections, we refer, because of their objects (manners,) to a moral sense; and call the taste or temper they excite, *moral*: and the objects which are agreeable to this taste or temper we denominate by the general name of *moral beauty*; in order to distinguish it from the other, which is termed *natural*.

These different sets of ideas or images are the materials about which the mind employs itself; which it blends, ranges, and diversifies ten thousand different ways. It feels a strong propension to connect and associate those ideas among which it observes any similitude, or any aptitude, whether original and natural, or customary and artificial, to suggest each other. See METAPHYSICS.

But whatever the reasons are, whether similitude, co-existence, causality, or any other aptitude or relation, why any two or more ideas are connected by the mind at first, it is an established law of our nature, "That when two or more ideas have often started in company, they form so strong an union, that it is very difficult ever after to separate them." Thus the lover cannot separate the idea of merit from his mistress; the courtier that of dignity from his title or ribbon; the miser that of happiness from his bags.—It is these associations of worth or happiness with any set of objects or images that form our taste or complex idea of good. By another law of our nature, "our affections follow and are governed by this taste; and to these affections our character and conduct are similar and proportioned, on the general tenor of which our happiness principally depends."

As all our leading passions, then, depend on the direction which our taste takes, and as it is always of the same strain with our leading associations, it is worth while to inquire a little more particularly how these are formed, in order to detect the secret sources from whence our passions derive their principal strength, their various rises

and falls. For this will give us the true key to their management, and let us into the right method of correcting the bad, and improving the good.

No kind of objects makes so powerful an impression on us as those which are immediately impressed on our senses, or strongly painted on our imaginations. Whatever is purely intellectual, as abstracted or scientific truths, the subtle relations and difference of things, has a fainter sort of existence in the mind; and, though it may exercise and whet the memory, the judgment, or the reasoning powers, gives hardly any impulse at all to the active powers, the passions, which are the main springs of motion. On the other hand, were the mind entirely under the direction of sense, and impressible only by such objects as are present and strike some of the outward organs, we should then be precisely in the state of the brute creation, and be governed solely by instinct or appetite, and have no power to controul whatever impressions are made upon us. Nature has therefore endued us with a middle faculty, wonderfully adapted to our mixed state; which holds partly of sense, and partly of reason; being strongly allied to the former, and the common receptacle in which all the notices that come from that quarter are treasured up; and yet greatly subservient and ministerial to the latter, by giving a body, a coherence, and beauty to its conceptions. This middle faculty is called the *imagination*, one of the most busy and fruitful powers of the mind. Into this common storehouse are likewise carried all those moral images or forms which are derived from our moral faculties of perception; and there they often undergo new changes and appearances, by being mixed and wrought up with the images and forms of sensible or natural things. By this coalition of imagery, natural beauty is dignified and heightened by moral qualities and perfections, and moral qualities are at once exhibited and set off by natural beauty. The sensible beauty, or good, is refined from its dross by partaking of the moral; and the moral receives a stamp, a visible character and currency from the sensible.

As we are first of all accustomed to sensible impressions and sensible enjoyments, we contract early a sensual relish or love of pleasure in the lower sense of the word. In order, however, to justify this relish, the mind, as it becomes open to higher perceptions of beauty and good, borrows from thence a nobler set of images, as fine taste, generosity, social affection, friendship, good-fellowship, and the like; and, by dressing out the old pursuits with these new ornaments, gives them an additional dignity and lustre. By these ways the desire of a table, love of finery, intrigue, and pleasure, are vastly increased beyond their natural pitch, having an impulse combined of the force of the natural appetites and of the superadded strength of those passions which tend to the moral species. —When the mind becomes more sensible to those objects or appearances, in which it perceives beauty, uniformity, grandeur, and harmony, as fine cloaths, elegant furniture, plate, pictures, gardens, houses, equipage, the beauty of animals, and particularly the attractions of the sex; to these objects the mind is led by nature, or taught by custom, the opinion and example of others, to annex certain ideas of moral character, dignity, decorum, ho-

nour, liberality, tenderness, and active or social enjoyment. The consequence of this association is, that the objects to which these are annexed, must rise in their value, and be pursued with proportionable ardor. The enjoyment of them is often attended with pleasure; and the mere possession of them, where that is wanting, frequently draws respect from one's fellow-creatures: this respect is, by many, thought equivalent to the pleasure of enjoyment. Hence it happens, that the idea of happiness is connected with the mere possession; which is therefore eagerly sought after, without any regard to the generous use, or honourable enjoyment. Thus the passion resting on the means, not the end, *i. e.* losing sight of its natural object, becomes wild and extravagant.

In fine, any object, or external denomination, a staff, a garter, a cup, a crown, a title, may become a moral badge or emblem of merit, magnificence, or honour, according as these have been found or thought by the possessors or admirers of them to accompany them; yet, by the deception formerly mentioned, the merit or the conduct which entitled, or should entitle, to those marks of distinction, shall be forgot or neglected, and the badges themselves be passionately affected, or pursued, as including every excellency. If these are attained by any means, all the concomitants which nature, custom, or accidents have joined to them, will be supposed to follow of course. Thus moral ends, with which the unhappy admirer is apt to colour over his passion and views, will, in his opinion, justify the most immoral means, as prostitution, adulation, fraud, treachery, and every species of knavery, whether more open or more disguised.

When men are once engaged in active life, and find that wealth and power, generally called *interest*, are the great avenues to every kind of enjoyment, they are apt to throw in many engaging moral forms to the object of their pursuit, in order to justify their passion, and varnish over the measures they take to gratify it; as, independency on the vices or passions of others, provision and security to themselves and friends, prudent oeconomy or well-placed charity, social communication, superiority to their enemies who are all villains, honourable service, and many other ingredients of merit. To attain such capacities of usefulness or enjoyment, what arts, nay, what meanesses can be thought blameable by those cool pursuers of interest! —Nor have they, whom the gay world is pleased to indulge with the title of *men of pleasure*, their imaginations less pregnant with moral images, with which they never fail to ennoble, or, if they cannot do that, to palliate their gross pursuits. Thus, admiration of wit, of sentiments and merit, friendship, love, generous sympathy, mutual confidence, giving and receiving pleasure, are the ordinary ingredients with which they season their gallantry and pleasurable entertainments; and by which they impose on themselves, and endeavour to impose on others, that their amours are the joint issue of good sense and virtue.

These associations, variously combined and proportioned by the imagination, form the chief private passions which govern the lives of the generality; as the love of action, of pleasure, power, wealth, and fame: they influence the defensive, and affect the public passions, and raise  
joy

joy or sorrow, as they are gratified or disappointed. So that, in effect, these associations of good and evil, beauty and deformity, and the passions they raise, are the main hinges of life and manners, and the great sources of our happiness or misery. It is evident, therefore, that the whole of moral culture must depend on giving a right direction to the leading passions, and duly proportioning them to the value of the objects or goods pursued, under what name soever they may appear.

Now, in order to give them this right direction and due proportion, it appears, from the foregoing detail, that those associations of ideas, upon which the passions depend, must be duly regulated: that is to say, as an exorbitant passion for wealth, pleasure, or power, flows from an association or opinion that more beauty and good, whether natural or moral, enters into the enjoyment or possession of them, than really belongs to either; therefore, in restoring those passions to their just proportion, we must begin with correcting the opinion, or breaking the false association; or, in other words, we must decompose the complex phantom of happiness or good, which we fondly admire; disunite those ideas, that have no natural alliance; and separate the original idea of wealth, power, or pleasure, from the foreign mixtures incorporated with it, which enhance its value, or give it its chief power to enchant and seduce the mind. For instance, let it be considered how poor and inconsiderable a thing wealth is, if it be disjoined from real use, or from ideas of capacity in the possessor to do good, from independency, generosity, provision for a family or friends, and social communication with others. By this standard let its true value be fixed; let its misapplication, or unbenevolent enjoyment, be accounted fordid and infamous; and nothing worthy or estimable be ascribed to the mere possession of it, which is not borrowed from its generous use.

If that complex form of good which is called *pleasure*, engages us, let it be analysed into its constituent principles, or those allurements it draws from the heart and imagination, in order to heighten the low part of the indulgence; let the separate and comparative moment of each be distinctly ascertained, and deduced from that gross part; and this remainder of the accumulative enjoyment will dwindle down into a poor, insipid, transitory thing. In proportion as the opinion of the good pursued abates, the admiration must decay, and the passion lose strength of course. One effectual way to lower the opinion, and consequently to weaken the habit founded on it, is to practice lesser pieces of self-denial, or to abstain, to a certain pitch, from the pursuit or enjoyment of the favourite object; and, that this may be the more easily accomplished, one must avoid those occasions, that company, those places, and the other circumstances that inflamed one, and endeared the other: And, as a counter-process, let higher or even different enjoyments be brought in view, other passions played upon the former, different places frequented, other exercises tried, company kept with persons of a different or more correct way of thinking both in natural and moral subjects.

As much depends on our setting out well in life, let the youthful fancy, which is apt to be very florid and luxuriant, be early accustomed, by instruction, example,

and significant moral exercises, nay, by looks, gestures, and every other testimony of just approbation or blame, to annex ideas of merit, honour, and happiness—not to birth, dress, rank, beauty, fortune, power, popularity, and the like outward things,—but to moral and truly virtuous qualities, and to those enjoyments which spring from a well-informed judgment, and a regular conduct of the affections, especially those of the social and disinterested kind. Such dignified forms of beauty and good, often suggested, and, by moving pictures and examples, warmly recommended to the imagination, enforced by the authority of conscience, and demonstrated by reason to be the surest means of enjoyment, and the only independent, undepriable and durable goods, will be the best counter-balance to meaner passions, and the firmest foundation and security to virtue.

It is of great importance to the forming a just taste, or pure and large conceptions of happiness, to study and understand human nature well, to remember what a complicated system it is, particularly to have deeply imprinted on our mind that gradation of senses, faculties, and powers of enjoyment formerly mentioned, and the subordination of goods resulting from thence, which nature points out, and the experience of mankind confirms; who, when they think seriously, and are not under the immediate influence of some violent prejudice or passion, prefer not the pleasures of action, contemplation, society, and most exercises and joys of the moral kind, as friendship, natural affection, and the like, to all sensual gratifications whatsoever? Where the different species of pleasure are blended into one complex form, let them be accurately distinguished, and be referred each to its proper faculty and sense, and examined apart what they have peculiar, what common with others, and what foreign and adventitious. Let wealth, grandeur, luxury, love, fame, and the like, be tried by this test, and their true alloy will be found out.—Let it be farther considered, whether the mind may not be easy, and enjoy itself greatly, though it want many of those elegancies and superfluities of life which some possess, or that load of wealth and power which others eagerly pursue, and under which they groan. Let the difficulty of attaining, the precariousness of possessing, and the many abatements in enjoying overgrown wealth and envied greatness, of which the weary possessors so frequently complain, as the hurry of business, the burden of company, of paying attendance to the few, and giving it to the many, the cares of keeping, the fears of losing, and the desires of increasing what they have, and the other troubles which accompany this pitiful drudgery and pompous servitude; let these and the like circumstances be often considered that are conducive to the removing or lessening the opinion of such goods, and the attendant passion or set of passions will decay of course.

Let the peculiar bent of our nature and character be observed, whether we are most inclined to form associations and relish objects of the sensible, intellectual, or moral kind. Let that which has the ascendant be particularly watched; let it be directed to right objects, be improved by proportioned exercises, and guarded by proper checks from an opposite quarter. Thus, the sensible

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turn may be exalted by the intellectual and a taste for the beauty of the fine arts, and both may be made subservient to convey and rivet sentiments highly moral and public-spirited. This inward force must extend to the strength and weakness of one's nature, one's condition, connections, habitudes, fortune, studies, acquaintance, and the other circumstances of one's life; from which every man will form the justest estimate of his own dispositions and character, and the best rules for correcting and improving them. And, in order to do this with more advantage, let those times or critical seasons be watched when the mind is best disposed towards a change, and let them be improved by vigorous resolutions, promises, or whatever else will engage the mind to persevere in virtue. Let the conduct, in fine, be often reviewed, and the causes of its corruption or improvement be carefully observed.

It will greatly conduce to refine the moral taste and strengthen the virtuous temper, to accustom the mind to the frequent exercise of moral sentiments and determinations, by reading history, poetry, particularly of the picturesque and dramatic kind, the study of the fine arts; by conversing with the most eminent for good-sense and virtue; but, above all, by frequent and repeated acts of humanity, compassion, friendship, politeness, and hospitality. It is exercise gives health and strength. He that reasons most frequently, becomes the wisest, and most enjoys the pleasures of wisdom. He who is most often affected by objects of compassion in poetry, history, or real life, will have his soul most open to pity and its delightful pains and duties. So he also who practises most diligently the offices of kindness and charity, will by it cultivate that disposition, from whence all his pretensions to personal merit must arise, his present and his future happiness.

An useful and honourable employment in life will administer a thousand opportunities of this kind and greatly strengthen a sense of virtue and good affections, which must be nourished by right training, as well as our understandings. For such an employment, by enlarging one's experience, giving an habit of attention and caution, or obliging one, from necessity or interest, to keep a guard over the passions, and study the outward decencies and appearances of virtue, will by degrees produce good habit, and at length insinuate the love of virtue and honesty for its own sake.

It is a great inducement to the exercise of benevolence, to view human nature in a favourable light, to observe the characters and circumstances of mankind on the fairest sides, to put the best constructions on their actions they will bear, and to consider them as the result of partial and mistaken, rather than ill affections, or, at worst, as the excesses of a pardonable self-love, seldom or never the effects of pure malice.

Above all, the nature and consequences of virtue and vice, their consequences being the law of our nature and will of heaven; the light in which they appear to our supreme Parent and Law-giver, and the reception they will meet with from him; must be often attended to. The exercises of piety, as adoration and praise of the Divine Excellency, invocation of and dependence on his aid, confession,

thanksgiving, and resignation, are habitually to be indulged, and frequently performed, not only as medicinal, but highly improving to the temper.

To conclude: It will be of admirable efficacy towards eradicating bad habits, and implanting good ones, frequently to contemplate human life as the great nursery of our future and immortal existence, as that state of probation in which we are to be educated for a divine life; to remember that our virtues or vices will be immortal as ourselves, and influence our future as well as our present happiness, and therefore that every disposition and action is to be regarded as pointing beyond the present to an immortal duration. An habitual attention to this wide and important connection will give a vast compass and dignity to our sentiments and actions, a noble superiority to the pleasures and pains of life, and a generous ambition to make our virtue as immortal as our being.

#### *Motives to Virtue from personal Happiness.*

We have already considered our obligations to the practice of virtue, arising from the constitution of our nature, by which we are led to approve a certain order and oeconomy of affections, and a certain course of action correspondent to it.—But besides this, there are several motives which strengthen and secure virtue, though not themselves of a moral kind. These are, its tendency to personal happiness, and the contrary tendency of vice. "Personal happiness arises, either from the state of a man's own mind, or from the state and disposition of external causes towards him."

We shall first examine the "tendency of virtue to happiness with respect to the state of a man's own mind."—This is a point of the utmost consequence in morals; because, unless we can convince ourselves, or shew to others, that, by doing our duty, or fulfilling our moral obligations, we consult the greatest satisfaction of our own mind, or our highest interest on the whole, it will raise strong and often unfurmountable prejudices against the practice of virtue, especially whenever there arises any appearance of opposition between our duty and our satisfaction or interest. To creatures so desirous of happiness and averse to misery as we are, and often so oddly situated amidst contending passions and interests, it is necessary that virtue appear not only an honourable, but a pleasing and beneficent form. And in order to justify our choice to ourselves, as well as before others, we must ourselves feel, and be able to avow in the face of the whole world, that her ways are ways of pleasantness, and her paths the paths of peace. This will shew, beyond all contradiction, that we not only approve, but can give a sufficient reason for what we do.

Let a man in a cool hour, when he is disengaged from business, and undisturbed by passion, as such cool hours will sometimes happen, sit down, and seriously reflect with himself what state or temper of mind he would chuse to feel and indulge, in order to be easy and to enjoy himself. Would he chuse, for that purpose, to be in a constant dissipation and hurry of thought; to be disturbed in the exercise of his reason; to have various, and often interfering phantoms of good playing before his imagination, soliciting and distracting him by turns, now soothing him

with

with amusing hopes, then torturing him with anxious fears; and to approve this minute what he shall condemn the next? Would he chuse to have a strong and painful sense of every petty injury; quick apprehensions of every impending evil; incessant and insatiable desires of power, wealth, honour, pleasure; an irreconcilable antipathy against all competitors and rivals; insolent and tyrannical dispositions to all below him; fawning, and at the same time envious, dispositions to all above him; with dark suspicions and jealousies of every mortal? Would he chuse neither to love, nor to be beloved of any; to have no friend in whom to confide, or with whom to interchange his sentiments or designs; no favourite, on whom to bestow his kindness, or vent his passions; in fine, to be conscious of no merit with mankind, no esteem from any creature, no good affection to his Maker, no concerns for or hopes of his approbation; but, instead of all these, to hate, and know that he is hated, to contemn, and know that he is contemned by all; by the good because he is so unlike, and by the bad because he is so like themselves; to hate or to dread the very Being that made him; and, in short, to have his breast the seat of pride and passion, petulance and revenge, deep melancholy, cool malignity, and all the other furies that ever possessed and tortured mankind?—Would our calm inquirer after happiness pitch on such a state, and such a temper of mind, as the most likely means to put him in possession of his desired ease and self-enjoyment?

Or would he rather chuse a serene and easy flow of thought; a reason clear and composed; a judgment unbiassed by prejudice, and undistracted by passion; a sober and well-governed fancy, which presents the images of things true and unmixed with delusive and unnatural charms, and therefore administers no improper or dangerous fuel to the passions, but leaves the mind free to chuse or reject, as becomes a reasonable creature; a sweet and sedate temper, not easily ruffled by hopes or fears, prone neither to suspicion nor revenge, apt to view men and things in the fairest lights, and to bend gently to the humours of others rather than obstinately to contend with them? Would he chuse such moderation and continence of mind, as neither to be ambitious of power, fond of honours, covetous of wealth, nor a slave to pleasure; a mind of course neither elated with success, nor dejected with disappointment; such a modest and noble spirit as supports power without insolence, wears honours without pride, uses wealth without profusion or parsimony; and rejoices more in giving than in receiving pleasure; such fortitude and equanimity as rises above misfortunes, or turns them into blessings; such integrity and greatness of mind, as neither flatters the vices, nor triumphs over the follies of men; as equally spurns servitude and tyranny, and will neither engage in low designs, nor abet them in others? Would he chuse, in fine, such mildness and benignity of heart as takes part in all the joys, and refuses none of the sorrows of others; stands well affected to all mankind; is conscious of meriting the esteem of all, and of being beloved by the best; a mind which delights in doing good without any shew, and yet arrogates nothing on that account; rejoices in loving and being beloved by its Maker, acts ever under his eye, resigns

itself to his providence, and triumphs in his approbation? Which of these dispositions would be his choice, in order to be contented, serene, and happy?—The former temper is *vice*, the latter *virtue*. Where one prevails, there misery prevails, and by the generality is acknowledged to prevail. Where the other reigns, there happiness reigns, and by the confession of mankind is acknowledged to reign. The perfection of either temper is misery, or happiness, in perfection. Therefore every approach to either extreme, is an approach to misery, or to happiness; that is to say, every degree of vice or virtue is accompanied with a proportionable degree of misery or happiness.

The principal alleviations of a virtuous man's calamities are these:—that, though some of them may have been the effect of his imprudence, or weakness; yet few of them are sharpened by a sense of guilt, and none of them by a consciousness of wickedness, which surely is their keenest sting:—that they are common to him with the best of men:—that they seldom or never attack him quite unprepared, but rather guarded with a consciousness of his own sincerity and virtue, with a faith and trust in providence, and a firm resignation to its perfect orders:—that they may be improved as means of correction, or materials to give scope and stability to his virtues:—and, to name no more, they are considerably lessened, and often sweetened to him, by the general sympathy of the wife and good.

His enjoyments are more numerous, or, if less numerous, yet more intense, than those of bad men: for he shares in the joys of others by rebound; and every increase of general or particular happiness is a real addition to his own. It is true, his friendly sympathy with others subjects him to some pains which the hard-hearted wretch does not feel; yet to give a loose to it, is a kind of agreeable discharge. It is such a sorrow as he loves to indulge; a sort of pleasing anguish, that sweetly melts the mind, and terminates in a self-approving joy. Tho' the good man may want means to execute, or be disappointed in the success of his benevolent purposes; yet he is still conscious of good affections; and that consciousness is an enjoyment of a more delightful favour than the greatest triumphs of successful vice. If the ambitious, covetous, or voluptuous, are disappointed, their passions recoil upon them with a fury proportioned to their opinion of the value of what they pursue, and their hope of success; while they have nothing within to balance the disappointment, unless it is an useful fund of pride, which however frequently turns mere accidents into mortifying affronts, and exalts grief into rage and frenzy. Whereas the meek, humble, and benevolent temper is its own immediate reward; is satisfied from within; and as it magnifies greatly the pleasure of success, so it wonderfully alleviates, and in a manner annihilates, all pain for the want of it.

As the good man is conscious of loving and wishing well to all mankind, he must be sensible of his deserving the esteem and goodwill of all; and this supposed reciprocation of social feelings, is, by the very frame of our nature, made a source of very intense and enlivening joys. By this sympathy of affections and interests he feels himself intimately united with the human race; and

being sensibly alive over the whole system, his heart receives and becomes responsive to every touch given to any part. So that he gathers contentment and delight from the pleased and happy state of those around him, from accounts and relations of such happinesses, from the very countenances, gestures, voices, and sounds even of creatures foreign to our kind, whose signs of joy and contentment he can any way discern.

Nor do those generous affections stop any other natural source of joy whatever, or deaden his sense of any innocent gratification. They rather keep the several senses and powers of enjoyment open and disengaged, intense, and uncorrupted by riot or abuse; as is evident to any one who considers the dissipated unfeeling state of men of pleasure, ambition, or interest, and compares it with the serene and gentle state of a mind at peace with itself, and friendly to all mankind, unruined by any violent emotion, and sensible to every good-natured and alluring joy.

It were easy, by going through the different sets of affections, to shew, that it is only by maintaining the proportion settled there that the mind arrives at true repose and satisfaction. If fear exceeds that proportion, it sinks into melancholy and dejection. If anger passes just bounds, it ferments into rage and revenge, or subsides into a sullen corroding gloom, which embitters every good, and renders one exquisitely sensible to every ill. The private passions, the love of honour especially, whose impulses are more generous as its effects are more diffusive, are instruments of private pleasure; but if they are disproportioned to our wants, or to the value of the several objects, or to the balance of other passions equally necessary and more amiable, they become instruments of intense pain and misery. For, being now destitute of that counterpoise which held them at a due pitch, they grow turbulent, peevish, and revengeful, the cause of constant restlessness and torment, sometimes flying out into a wild delirious joy, at other times settling into a deep splenic grief. The concert between reason and passion is then broke: all is dissonance and distraction within. The mind is out of frame, and feels an agony proportioned to the violence of the reigning passion.

The case is much the same, or rather worse, when any of the particular kind affections are out of their natural order and proportion; as happens in the case of effeminate pity, exorbitant love, parental dotage, or any party passion, where the just regards to society are supplanted. The more social and disinterested the passion is, it breaks out into the wilder excesses, and makes the more dreadful havoc, both within and abroad, as is but too apparent in those cases where a false species of religion, honour, zeal, or party-rage, has seized on the natural enthusiasm of the mind, and worked it up to madness. It breaks through all ties natural and civil, counteracts the most sacred and solemn obligations, silences every other affection whether public or private, and transforms the most gentle natures into the most savage and inhuman.

Whereas the man who keeps the balance of affection even, is easy and serene in his motions; mild, and yet affectionate; uniform and consistent with himself; is not

liable to disagreeable collisions of interests and passions; gives always place to the most friendly and humane affections; and never to dispositions or acts of resentment, but on high occasions, when the security of the private, or welfare of the public system, or the great interests of mankind necessarily require a noble indignation; and even then he observes a just measure in wrath; and last of all, he proportions every passion to the value of the object he affects, or to the importance of the end he pursues.

To sum up this part of the argument, the honest and good man has eminently the advantage of the knavish and selfish wretch in every respect. The pleasures which the last enjoys flow chiefly from external advantages and gratifications; are superficial and transitory; dashed with long intervals of satiety, and frequent returns of remorse and fear; dependent on favourable accidents and conjunctures; and subjected to the humours of men. But the good man is satisfied from himself; his principal possessions lie within, and therefore beyond the reach of the caprice of men or fortune; his enjoyments are exquisite and permanent; accompanied with no inward checks to damp them, and always with ideas of dignity and self-approbation; may be tasted at any time, and in any place. The gratifications of vice are turbulent and unnatural, generally arising from the relief of passions in themselves intolerable, and issuing in tormenting reflections; often irritated by disappointment, always inflamed by enjoyment, and yet ever cloyed with repetition. The pleasures of virtue are calm and natural; flowing from the exercise of kind affections, or delightful reflections in consequence of them; not only agreeable in the prospect, but in the present feeling; they never satiate, or lose their relish; nay, rather the admiration of virtue grows stronger every day; and not only is the desire but the enjoyment heightened by every new gratification; and, unlike to most others, it is increased, not diminished, by sympathy and communication. In fine, the satisfactions of virtue may be purchased without a bribe, and possessed in the humblest as well as the most triumphant fortune; they can bear the strictest review, do not change with circumstances, nor grow old with time. Force cannot rob, nor fraud cheat us of them; and, to crown all, instead of abating, they enhance every other pleasure.

But the happy consequences of virtue are seen, not only in the internal enjoyments it affords a man, but "in the favourable disposition of external causes towards him, to which it contributes."

As virtue gives the sober possession of one's self and the command of one's passions, the consequence must be, heart's ease, and a fine natural flow of spirits, which conduce more than any thing else to health and long life. Violent passions, and the excesses they occasion, gradually impair and wear down the machine. But the calm placid state of a temperate mind, and the healthful exercises in which virtue engages her faithful votaries, preserve the natural functions in full vigour and harmony, and exhilarate the spirits, which are the chief instruments of action.

It may by some be thought odd to assert, that virtue is no enemy to a man's fortune in the present state of things.

things.—But if, by fortune, be meant a moderate or competent share of wealth, power, or credit, not overgrown degrees of them, what should hinder the virtuous man from obtaining that? He cannot cringe or fawn, it is true; but he can be civil and obliging as well as the knave: and surely, his civility is more alluring, because it has more manliness and grace in it than the mean adulation of the other: he cannot cheat or undermine; but he may be cautious, provident, watchful of occasions, and equally prompt with the rogue in improving them: he scorns to prostitute himself as a pander to the passions, or as a tool to the vices of mankind; but he may have as sound an understanding, and as good capacities for promoting their real interests, as the vilest court-slave; and then, he is more faithful and true to those who employ him. In the common course of business, he has the same chances with the knave of acquiring a fortune, and rising in the world. He may have equal abilities, equal industry, equal attention to business; and in other respects he has greatly the advantage of him. People love better to deal with him; they can trust him more; they know he will not impose on them, nor take advantage of them, and can depend more on his word than on the oath or strongest securities of others. Whereas what is commonly called cunning, which is the offspring of ignorance, and constant companion of knavery, is not only a mean-spirited, but a very short-sighted talent, and a fundamental obstacle in the road of business. It may procure indeed immediate and petty gains; but it is attended with dreadful abatements, which do more than over-balance them, both as it sinks a man's credit when discovered, and cramps that largeness of mind, which extends to the remotest as well as the nearest interest, and takes in the most durable equally with the most transient gains. It is therefore easy to see how much a man's credit and reputation, and consequently his success, depend on his honesty and virtue.

With regard to security and peace with his neighbours, it may be thought, perhaps, that the man of a quiet forgiving temper, and a flowing benevolence and courtesy, is much exposed to injury and affronts from every proud or peevish mortal who has the power or will to do mischief. If we suppose, indeed, this quietness and gentleness of nature accompanied with cowardice or pusillanimity, this may often be the case; but in reality, the good man is bold as a lion, and so much the bolder for being the calmer. Such a person will hardly be a butt to mankind. The ill-natured will be afraid to provoke him, and the good-natured will not incline to do it. Besides, true virtue, which is conducted by reason, and exerted gracefully and without parade, is a most insinuating and commanding thing; if it cannot disarm malice and resentment at once, it will wear them out by degrees, and subdue them at length. How many have, by favours, and prudently yielding, triumphed over an enemy who would have been inflamed into tenfold rage by the fiercest opposition? In fine, goodness is the most universally popular thing that can be.

To conclude, the good man may have some enemies, but he will have more friends; and having given so many marks of private friendship or public virtue, he can hard-

ly be destitute of a patron to protect, or a sanctuary to entertain him, or to entertain or protect his children when he is gone. Though he should have little else to leave them, he bequeaths them the fairest, and generally the most unenvied, inheritance of a good name; which, like good seed sown in the field of futurity, will often raise up unsolicited friends, and yield a benevolent harvest of unexpected charities. But should the fragrance of the parent's virtue prove offensive to a perverse or envious age, or even draw persecution on the friendless orphans, there is One in heaven, who will be more than a father to them, and recompence their parent's virtues by showering down blessings on them.

*Motives to Virtue from the BEING and PROVIDENCE of GOD.*

BESIDES the interesting motive mentioned in the last section, there are two great motives to virtue, strictly connected with human life, and resulting from the very constitution of the human mind. The first is the being and providence of God; the second is the immortality of the soul, with future rewards and punishments.

It appears from what has been said, that man, by the constitution of his nature, is designed to be a religious creature. He is intimately connected with the Deity, and necessarily dependent on him. From that connection and necessary dependence result various obligations and duties; without fulfilling which, some of his sublimest powers and affections would be incomplete and abortive. If he be likewise an immortal creature, and if his present conduct shall affect his future happiness in another state as well as in the present; it is evident, that we take only a partial view of the creature if we leave out this important property of his nature, and make a partial estimate of human life if we strike out of the account, or over-look, that part of his duration which runs out into eternity.

It is evident, that "to have a respect to the Deity in our temper and conduct, to venerate and love his character, to adore his goodness, to depend upon and resign ourselves to his providence, to seek his approbation, and act under a sense of his authority, is a fundamental part of moral virtue, and the completion of the highest destination of our nature."

But as piety is an essential part of virtue, so likewise it is a great support and enforcement to the practice of it. To contemplate and admire a being of such transcendent dignity and perfection as God, must naturally and necessarily open and enlarge the mind, give a freedom and amplitude to its powers, and a grandeur and elevation to its aims. For, "the greatness of an object, and the excellency of the act of any agent about a transcendent object, doth mightily tend to the enlargement and improvement of his faculties." Little objects, mean company, mean cares, and mean business, cramp the mind, contract its views, and give it a creeping air and deportment. But when it soars above mortal cares and mortal pursuits into the regions of divinity, and converses with the Greatest and Best of Beings, it spreads itself into a wider compass, takes higher flights in reason and goodness, and becomes Godlike in its air and manners. Virtue is, if one may say so, both the effect and cause of largeness of mind. It requires

requires that one think freely, and act nobly. Now, what can conduce more to freedom of thought and dignity of action, than to conceive worthily of God, to reverence and adore his unrivalled excellency, to imitate and transcribe that excellency into our own nature, to remember our relation to him, and that we are the image and representatives of his glory to the rest of the creation? Such feelings and exercises must and will make us scorn all actions that are base, unhandsome, or unworthy our state; and the relation we stand in to God will irradiate the mind with the light of wisdom, and ennoble it with the liberty and dominion of virtue.

The influence and efficacy of religion may be considered in another light. We all know that the presence of a friend, a neighbour, or any number of spectators, but especially an august assembly of them, uses to be a considerable check upon the conduct of one who is not lost to all sense of honour and shame, and contributes to restrain many irregular sallies of passion. In the same manner we may imagine, that the awe of some Superior Mind, who is supposed privy to our secret conduct, and armed with full power to reward or punish it, will impose a restraint on us in such actions as fall not under the controul or animadversion of others. If we go still higher, and suppose our inmost thoughts and darkest designs, as well as our most secret actions, to lie open to the notice of the Supreme and Universal Mind, who is both the spectator and judge of human actions; it is evident, that the belief of so august a presence, and such awful inspection, must carry a restraint and weight with it proportioned to the strength of that belief, and be an additional motive to the practice of many duties which would not have been performed without it.

It may be observed farther, that "to live under an habitual sense of the Deity and his great administration, is to be conversant with wisdom, order, and beauty, in the highest subjects, and to receive the delightful reflections and benign feelings which these excite, while they irradiate upon him from every scene of nature and providence." How improving must such views be to the mind, in dilating and exalting it above those puny interests and competitions which agitate and enflame the bulk of mankind against each other!—

*Motive to Virtue from the Immortality of the Soul, &c.*

THE other motive mentioned was the immortality of the soul, with future rewards and punishments. The metaphysical proofs of the soul's immortality, are commonly drawn—from its simple, uncompounded, and indivisible nature; from whence it is concluded, that it cannot be corrupted or extinguished by a dissolution or destruction of parts:—from its having a beginning of motion within itself; whence it is inferred, that it cannot discontinue and lose its motion:—from the different properties of matter and mind; the sluggishness and inactivity of one, and the immense activity of the other; its prodigious flight of thought and imagination; its penetration, memory, foresight, and anticipations of futurity; from whence it is concluded, that a being of so divine a nature cannot be extinguished. But as these metaphysical proofs depend on intricate reasonings concerning the nature, properties,

and distinction of body and mind, with which we are not very well acquainted, they are not obvious to ordinary understandings, and are seldom so convincing, even to those of higher reach, as not to leave some doubts behind them. Therefore, perhaps, it is not so safe to rest the proof of such an important article on what many may call the subtleties of school-learning. Those proofs which are brought from analogy, from the moral constitution and phenomena of the human mind, the moral attributes of God, and the present course of things, and which are therefore called the moral arguments, are the plainest, and generally the most satisfying. We shall select only one or two from the rest.

In tracing the nature and destination of any being, we form the surest judgment from his powers of action, and the scope and limits of these, compared with his state, or with that field in which they are exercised. If this being passes through different states or fields of action, and we find a succession of powers adapted to the different periods of his progress, we conclude that he was destined for those successive states, and reckon his nature progressive. If, besides the immediate set of powers which fit him for action in his present state, we observe another set which appears superfluous if he was to be confined to it, and which point to another or higher one, we naturally conclude, that he is not designed to remain in his present state, but to advance to that for which those supernumerary powers are adapted. Thus we argue, that the insect, which has wings forming or formed, and all the apparatus proper for flight, is not destined always to creep on the ground, or to continue in the torpid state of adhering to a wall, but is designed in its season to take its flight in air. Without this farther destination, the admirable mechanism of wings, and the other apparatus, would be useless and absurd. The same kind of reasoning may be applied to man, while he lives only a sort of vegetative life in the womb. He is furnished even there with a beautiful apparatus of organs, eyes, ears, and other delicate senses, which receive nourishment indeed, but are in a manner folded up, and have no proper exercise or use in their present confinement. Let us suppose some intelligent spectator, who never had any connection with man, nor the least acquaintance with human affairs, to see this odd phenomenon; a creature formed after such a manner, and placed in a situation apparently unsuitable to such various machinery; must he not be strangely puzzled about the use of his complicated structure, and reckon such a profusion of art and admirable workmanship lost on the subject; or reason, by way of anticipation, that a creature, endued with such various, yet unexercised capacities, was destined for a more enlarged sphere of action, in which those latent capacities shall have full play? The vast variety, and yet beautiful symmetry and proportions, of the several parts and organs with which the creature is endued, and their apt cohesion with, and dependence on, the curious receptacle of their life and nourishment, would forbid his concluding the whole to be the birth of chance, or the bungling effort of an unskilful artist, at least would make him demur a while at so harsh a sentence. But if, while he is in this state of uncertainty, we suppose him to see the babe, after a few successful struggles,

struggles, throwing off his fetters, breaking loose from his little dark prison, and emerging into open day; then unfolding his recluse and dormant powers, breathing in air, gazing at light, admitting colours, sounds, and all the fair variety of nature; immediately his doubts clear up, the propriety and excellency of the workmanship dawn upon him with full lustre, and the whole mystery of the first period is unravelled by the opening of this new scene. Though in this second period the creature lives chiefly a kind of animal life, *i. e.* of sense and appetite; yet by various trials and observations he gains experience, and by the gradual evolution of the powers of imagination he ripens apace for an higher life, for exercising the arts of design and imitation, and of those in which strength or dexterity are more requisite than acuteness or reach of judgment. In the succeeding rational or intellectual period, his understanding, which formerly crept in a lower, mounts into an higher sphere, canvasses the natures, judges of the relations of things, forms schemes, deduces consequences from what is past, and from present as well as past collects future events. By this succession of states, and of correspondent culture, he grows up at length into a moral, social, and a political creature. This is the last period, at which we perceive him to arrive in this his mortal career. Each period is introductory to the next succeeding one; each life is a field of exercise and improvement for the next higher one, the life of the fœtus for that of the infant, the life of the infant for that of the child, and all the lower for the highest and best.—But is this the last period of nature's progression? Is this the utmost extent of her plot, where she winds up the drama, and dismisses the actor into eternal oblivion! Or does he appear to be invested with supernumerary powers, which have not full exercise and scope, even in the last scene, and reach not that maturity or perfection of which they are capable; and therefore point to some higher scene, where he is to sustain another and more important character than he has yet sustained? If any such there are, may we not conclude by analogy, or in the same way of anticipation as before, that he is destined for that afterpart, and is to be produced upon a more august and solemn stage, where his sublimer powers shall have proportioned action, and its nature attain its completion?

If we attend to that curiosity, or prodigious thirst of knowledge, which is natural to the mind in every period of its progress; and consider withal the endless round of business and care, and the various hardships to which the bulk of mankind are chained down; it is evident, that in this present state, it is impossible to expect the gratification of an appetite at once so insatiable and so noble. Our senses, the ordinary organs by which knowledge is let into the mind, are always imperfect, and often fallacious; the advantages of assisting, or correcting them, are possessed by few; the difficulties of finding out truth amidst the various and contradictory opinions, interests, and passions of mankind, are many; and the wants of the creature, and of those with whom he is connected, numerous and urgent; so that it may be said of most men, that their intellectual organs are as much shut up and secluded from proper nourishment and exercise in that little circle to which they are confined, as the bodily organs

are in the womb. Nay, those who to an aspiring genius have added all the assistances of art, leisure, and the most liberal education, what narrow prospects can even they take of this unbounded scene of things from that little eminence on which they stand? And how eagerly do they still grasp at new discoveries, without any satisfaction or limit to their ambition?

But should it be said, that man is made for action, and not for speculation, or fruitless searches after knowledge; we ask, For what kind of action? Is it only for bodily exercises; or for moral, political, and religious ones? Of all these he is capable: yet, by the unavoidable circumstances of his lot, he is tied down to the former; and has hardly any leisure to think of the latter; or, if he has, wants the proper instruments of exerting them. The love of virtue, of one's friends and country, the generous sympathy with mankind, and heroic zeal of doing good, which are all so natural to great and good minds, and some traces of which are found in the lowest, are seldom united with proportioned means or opportunities of exercising them; so that the moral spring, the noble energies and impulses of the mind, can hardly find proper scope, even in the most fortunate condition; but are much depressed in some, and almost entirely restrained in the generality, by the numerous clogs of an indigent, sickly, or embarrassed life. Were such mighty powers, such Godlike affections planted in the human breast, to be folded up in the narrow womb of our present existence, never to be produced into a more perfect life, nor to expatiate in the ample career of immortality?

Let it be considered, at the same time, that no possession, no enjoyment within the round of mortal things, is commensurate to the desires, or adequate to the capacities of the mind. The most envied condition has its abatements; the happiest conjuncture of fortune leaves many wishes behind; and after the highest gratifications, the mind is carried forward in pursuit of new ones without end. Add to all, the fond desire of immortality, the secret dread of non-existence, and the high unremitting pulse of the soul beating for perfection, joined to the improbability or the impossibility of attaining it here; and then judge whether this elaborate structure, this magnificent apparatus of inward powers and organs, does not plainly point out an hereafter, and intimate eternity to man? Does nature give the finishing touches to the lesser and ignobler instances of her skill, and raise every other creature to the maturity and perfection of his being; and shall she leave her principal workmanship unfinished? Does she carry the vegetative and animal life in man to their full vigour, and highest destination; and shall she suffer his intellectual, his moral, his divine life to fade away, and be for ever extinguished? Would such abortions in the moral world be congruous to that perfection of wisdom and goodness which upholds and adorns the natural?

We must therefore conclude, from this detail, that the present state, even at its best, is only the womb of man's being, in which the noblest principles of his nature are in a manner fettered or secluded from a correspondent sphere of action; and therefore destined for a future and unbounded state, where they shall emancipate themselves,

and exert the fulness of their strength. The most accomplished mortal, in this low and dark apartment of nature, is only the rudiments of what he shall be, when he takes his ethereal flight, and puts on immortality. Without a reference to that state, man were a mere abortion, a rude unfinished embryo, a monster in nature. But this being once supposed, he still maintains his rank, of the master-piece of the creation; his latent powers are all suitable to the harmony and progression of nature; his noble aspirations, and the pains of his dissolution, are his efforts towards a second birth, the pangs of his delivery into light, liberty, and perfection; and death his discharge from gaol, his separation from his fellow-prisoners, and introduction into the assembly of those heroic spirits who are gone before him, and of their great eternal Parent. The fetters of his mortal coil being loosened, and his prison-walls broke down, he will be bare and open on every side to the admission of truth and virtue, and their fair attendant happiness; every vital and intellectual spring will evolve itself, with a divine elasticity, in the free air of heaven. He will not then peep at the universe and its glorious Author through a dark grate, or a gross medium, nor receive the reflections of his glory through the strait openings of sensible organs; but will be all eye, all ear, all ethereal and divine feeling.—Let one part, however, of the analogy be attended to; That, as in the womb we receive our original constitution, form, and the essential stamina of our being, which we carry along with us into the light, and which greatly affect the succeeding periods of our life; so our temper and condition in the future life will depend on the conduct we have observed, and the character we have formed in the present life. We are here in miniature what we shall be at full length hereafter. The first rude sketch, or out-lines of reason and virtue, must be drawn at present, to be afterwards enlarged to the stature and beauty of angels.

This, if duly attended to, must prove not only a guard, but an admirable incentive to virtue. For he who faithfully and ardently follows the light of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that pursuit, by a full conviction that the scene does not close with life;—that his struggles arising from the weakness of nature, and the strength of habit, will be turned into triumphs;—that his career in the tracts of wisdom and goodness will be both swifter and smoother;—and those generous ardors with which he glows towards heaven, *i. e.* the perfection and immortality of virtue, will find their adequate object and exercise in a sphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpressible damp must it be to the good man, to dread the total extinction of that light and virtue, without which life, nay immortality itself, were not worth a single wish?

Many writers draw their proofs of the immortality of the soul, and of a future state of rewards and punishments, from the unequal distribution of these here. It cannot be dissembled that wicked men often escape the outward punishment due to their crimes, and do not feel the inward in that measure their demerit seems to require, partly from the callousness induced upon their nature by the habits of vice, and partly from the dissipation of their

minds abroad by pleasure or business; and sometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeseen or unavoidable calamities in which they are involved. This, no doubt, upon the supposition of an all-wise and good Providence, were an argument, and a strong one too, for a future state, in which those inequalities shall be corrected. But unless we suppose a prepollent good order in the present scene of things, we weaken the proof of the divine administration, and the presumption of better order in any future period of it.

Virtue has present rewards, and vice present punishments, annexed to it; such rewards and punishments as make virtue, in most cases that happen, far more eligible than vice: but, in the infinite variety of human contingencies, it may sometimes fall out, that the inflexible practice of virtue shall deprive a man of considerable advantages to himself, his family, or friends, which he might gain by a well-timed piece of roguery, suppose by betraying his trust, voting against his conscience, selling his country, or any other crime where the security against discovery shall heighten the temptation. Or, it may happen, that a strict adherence to his honour, to his religion, to the cause of liberty and virtue, shall expose him, or his family, to the loss of every thing, nay to poverty, slavery, death itself, or to torments far more intolerable. Now, what shall secure a man's virtue in circumstances of such trial? What shall enforce the obligations of conscience against the allurements of so many interests, the dread of so many and so terrible evils, and the almost unsurmountable aversion of human nature to excessive pain? The conflict is the greater, when the circumstances of the crime are such as easily admit a variety of alleviations from necessity, natural affection, love to one's family, or friends, perhaps in indigence: These will give it even the air of virtue. Add to all, that the crime may be thought to have few bad consequences,—may be easily concealed,—or imagined possible to be retrieved in a good measure by future good conduct. It is obvious to which side most men will lean in such a case, and how much need there is of a balance in the opposite scale, from the consideration of a God, of a providence, and of an immortal state of retribution, to keep the mind firm and incorrupt in those or like instances of singular trial or distress.

But without supposing such peculiar instances, a sense of a Governing Mind, and a persuasion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards suitable to its nature, vast in themselves, and immortal in their duration, must be not only a mighty support and incentive to the practice of virtue, but a strong barrier against vice. The thoughts of an almighty Judge, and of an impartial future reckoning, are often alarming, inexpressibly so, even to the stoutest offenders. On the other hand, how supporting must it be to the good man, to think that he acts under the eye of his Friend, as well as Judge! How improving, to consider the present state as connected with a future one, and every relation in which he stands as a school of discipline for his affections, every trial as the exercise of some virtue, and the virtuous deeds which result from both as introductory to higher scenes of action and enjoyment! Finally, how transporting

transporting is it to view death as his discharge from the warfare of mortality, and a triumphant entry into a state of freedom, security, and perfection; in which knowledge and wisdom shall break upon him from every quarter; where each faculty shall have its proper object; and his virtue, which was often damped or defeated here, shall be enthroned in undisturbed and eternal empire!

On reviewing this short system of morals, and the motives which support and enforce it, and comparing both with the Christian scheme, what light, and vigour do they borrow from thence! How clearly and fully does Christianity lay open the connections of our nature, both material and immaterial, and future as well as present! What an ample and beautiful detail does it present of the duties we owe to God, to society, and ourselves; promulgated in the most simple, intelligible, and popular manner; divested of every partiality of sect or nation; and adapted to the general state of mankind! With what bright and alluring examples does it illustrate and recommend the practice of those duties; and with what mighty sanctions does it enforce that practice! How strongly does it

describe the corruptions of our nature; the deviations of our life, from the rule of duty; and the causes of both! How marvellous and benevolent a plan of redemption does it unfold, by which those corruptions may be remedied, and our nature restored to its deviations, to transcendent heights of virtue and piety! Finally, what a fair and comprehensive prospect does it give us of the administration of God, of which it represents the present state only as a small period; and a period of warfare and trial! How solemn and unbounded are the scenes which it opens beyond it; the resurrection of the dead; the general judgment; the equal distribution of rewards and punishments to the good and the bad; and the full completion of divine wisdom and goodness in the final establishment of order, perfection, and happiness!—How glorious then is that scheme of religion, and how worthy of affection as well as of admiration, which, by making such discoveries, and affording such assistances, has disclosed the unfading fruits and triumphs of virtue, and secured its interests beyond the power of time and chance!

## M O R

**MORAL SENSE**, that whereby we perceive what is good, virtuous, and beautiful in actions, manners, and characters. See **MORALS**.

**MORALITY**. See **MORAL PHILOSOPHY**.

**MORASS**, a low, moist land, which receives the waters from the higher grounds without having any descent to carry them off.

**MORAVIA**, a marquifate, or province in Bohemia, bounded by Silesia on the north-east, by Hungary and Austria on the south, and by Bohemia on the north-west.

**MORAVIANS**, a sect of Protestants, who have been settled for a considerable time past at Hernhuth in Germany, and have of late years spread themselves over most of our American colonies, as well as in several parts of England, where they are permitted to settle by a late act of parliament. They have a kind of church-government peculiar to themselves, and are commonly known by the name of *Unitas Fratrum*, or *The Brethren*. They profess the utmost veneration for our blessed Saviour, whom they consider as their immediate Head and Director; enjoin the most implicit obedience to the rulers of their church; and are said to practise much brotherly love amongst one another.

**MORBID**, among physicians, signifies diseased or corrupt; a term applied either to an unfound constitution, or to those parts or humours that are infected by a disease.

**MORDELLA**, in zoology, a genus of the coleoptera class of insects. The antennæ are thread-shaped, and serrated; the head is deflexed under the neck; the pappi are clavated, compressed, and obliquely blunted; and the elytra are bent backwards near the apex. There are six species, all natives of different parts of Europe.

**MOREA**, the ancient Peloponnesus, is a province of European Turkey, and is a peninsula about one hun-

## M O R

dred and eighty miles long, and one hundred and thirty broad, bounded by the gulphs of Lepanto and Engia on the north; by the Egean sea, or Archipelago, on the east; and by the Mediterranean on the south and west.

**MORESK**, or **MORISCO**, is a kind of painting, carving, &c. done after the manner of the Moors; consisting of several grotesque pieces and compartments, promiscuously mingled, not containing any perfect figure of a man, or other animal; but a wild resemblance of birds, beasts, trees, &c.

**MORGAY**, in ichthyology. See **SQUALUS**.

**MORINA**, in botany, a genus of the diandria monogynia class. The corolla is unequal; the calix of the fruit consists of one dentated leaf; the calix of the flower is bifid; and there is but one seed under the flower-calix. There is but one species, a native of Persia.

**MORINDA**, in botany, a genus of the pentandria monogynia class. The flowers are aggregate and monopetalous; the stigma is bifid; and the drupæ are aggregate. There are three species, none of them natives of Britain.

**MORINELLUS**, in ornithology. See **CHARADRIUS**.

**MORISONA**, a genus of the polyandria monogynia class. The corolla consists of four petals, and the calix of two segments; the berry is hard, and contains one seed. There is but one species, a native of America.

**MORLAIX**, a port-town of France, in the province of Britany: W. long. 4°, N. lat. 48° 37'.

**MORMYLUS**, in ichthyology. See **SPARUS**.

**MORNING**, the beginning of the day, the first appearance of light, or the time from midnight till noon.

**MOROCCO**, the capital of the kingdom of the same name in Africa: W. long. 9°, N. lat. 32°.

**MOROCHTHUS**, in natural history, an indurated clay, called by us French chalk; serving taylors and others

to mark with. The ancients esteemed it as an astringent, prescribing it in the colic, hæmorrhages and other fluxes.

**MORPETH**, a borough-town of Northumberland, fourteen miles north of Newcastle, which sends two members to parliament.

**MORTALITY**, or *Bills of MORTALITY*, properly denote weekly lists of the persons who die in any place. See **ANNUITIES**.

*Brief of MORTANCESTRY*, in Scots law; anciently the ground of an action at the instance of an heir, in the special case where he had been excluded from the possession of his ancestor's estate by the superior or other person pretending right.

**MORTAR**, a preparation of lime and sand mixed up with water, which serves as a cement, and is used by masons and bricklayers in building of walls of stone and brick.

**MORTAR-PIECE**. See **GUNNERY**.

**MORTGAGE**, in law, a pledge or pawn of lands, tenements, &c. for money borrowed; so called, because if the money is not paid at the day, the land dies to the debtor, and is forfeited to the creditor.

**MORTIER**, an ensign of dignity, borne by the chancellor and grand presidents of the parliament of France. That borne by the chancellor, is a piece of cloth of gold, edged and turned up with ermine; and that of the first president is a piece of black velvet edged with a double row of gold lace, while that of the other presidents is only edged with a single row. This they formerly carried on their heads, as they do still in grand ceremonies, such as the entry of the king; but, ordinarily, they carry them in the hand.

**MORTISE**, or **MORTOISE**, in carpentry, &c. a kind of joint, wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a tenon.

**MORTMAIN**, in law, is the alienation of lands or tenements to any religious house, corporation, or fraternity, and their successors.

**MORTUARY**, in the ecclesiastical law, is a gift left by a man at his death to his parish church, in recompence of personal tithes omitted to be paid in his lifetime: or it is that beast, or other cattle, which, after the death of the owner, by the custom of the place, is due to the parson or vicar, in lieu of tithes or offerings forgot, or not well and truly paid by him that is dead.

**MORUS**, in botany, a genus of the monœcia tetrandria class. The calix of the male has four segments; it has no corolla: The calix of the female consists of four leaves; it has no corolla: the styli are two, and the berry contains one seed. There are seven species, none of them natives of Britain.

**MOSAIC**, or **MOSAIC-WORK**, an assemblage of little pieces of glass, marble, precious stones, &c. of various colours, cut square, and cemented on a ground of stucco, in such a manner as to imitate the colours and degradations of painting.

*Method of performing MOSAIC-WORK of glass is this:*

They provide little pieces of glass, of as many different colours and sizes as possible.

Now, in order to apply these several pieces, and out of them to form a picture, they in the first place procure a cartoon or design to be drawn; this is transferred to the ground or plaster by calking, as in painting in fresco. See **FRESCO**.

As this plaster is to be laid thick on the wall, and therefore will continue fresh and soft a considerable time, so that there may be enough prepared at once, to serve for as much work as will take up three or four days.

This plaster is composed of lime, made of hard stone, with brick dust very fine, gum tragacanth, and whites of eggs: when this plaster has been thus prepared and laid on the wall, and made the design of what is to be represented, they take out the little pieces of glass with a pair of pliers, and range them one after another, still keeping strictly to the light, shadow, different taints and colours represented in the design before; pressing or flattening them down with a ruler, which serves both to sink them within the ground, and to render the surface even.

Thus in a long time, and with a great deal of labour, they finish the work, which is still the more beautiful, as the pieces of glass are more uniform, and ranged at an even height.

Some of these pieces of mosaic-work are performed with that exactness, that they appear as smooth as a table of marble, and as finished and masterly as a painting in fresco; with this advantage, that they have a fine lustre, and will last ages.

The finest works of this kind that have remained till our time, and those by whom the moderns have retrieved the art, which was in a manner lost, are those in the church of St Agnes, formerly the temple of Bacchus at Rome; and some at Pisa, Florence, and other cities of Italy. The most esteemed among the works of the moderns are those of Joseph Pine, and the chevalier Lanfranc in the church of St Peter at Rome: there are also very good ones at Venice.

*Method of performing MOSAIC-WORK of marble and precious stones is this:* The ground of mosaic-works, wholly marble, is usually a massive marble, either white or black. On this ground the design is cut with a chissel, after it has been first calqued. After it has been cut of a considerable depth, *i. e.* an inch or more, the cavities are filled up with marble of a proper colour, first fashioned according to the design, and reduced to the thickness of the indentures with various instruments. To make the pieces thus inserted into the indentures cleave fast, whose several colours are to imitate those of the design, they use a stucco, composed of lime and marble-dust; or a kind of mastic, which is prepared by each workman, after a different manner peculiar to himself.

The figures being marked out, the painter or sculptor himself draws with a pencil the colours of the figures, not determined by the ground, and in the same manner makes strokes or hatchings in the place, with

where shadows are to be: and after he has engraven with the chissel all the strokes thus drawn, he fills them up with a black mastic, composed partly of burgundy-pitch poured on hot; taking off afterwards what is superfluous with a piece of soft stone or brick, which, together with water and beaten cement, takes away the mastic, polishes the marble, and renders the whole so even that one would imagine it only consisted of one piece.

This is the kind of mosaic-work that is seen in the pompous church of the invalids at Paris, and the fine chapel at Versailles, with which some entire apartments of that palace are incrustated.

As for mosaic-work of precious stones, other and finer instruments are required than those used in marble; as drills, wheels, &c. used by lapidaries and engravers on stone. As none but the richest marbles and stones enter this work, to make them go farther, they are sawn into the thinnest leaves imaginable, scarce exceeding half a line in thickness; the block to be sawn is fastened firmly with cords on the bench, and only raised a little on a piece of wood, one or two inches high. Two iron pins, which are on one side the block, and which serve to fasten it, are put into a vice contrived for the purpose; and with a kind of saw or bow, made of fine brass-wire, bent on a piece of spongy wood, together with emery steeped in water, the leaf is gradually fashioned by following the stroke of the design, made on paper, and glued on the piece. When there are pieces enough fastened to form an entire flower, or some other part of the design, they are applied to the ground.

The ground which supports this mosaic-work is usually of free-stone. The matter with which the stones are joined together, is a mastic, or kind of stucco, laid very thin on the leaves as they are fashioned; and this being done, the leaves are applied with pliers.

If any contour, or side of a leaf, be not either squared or rounded sufficiently, so as to fit the place exactly, into which it is to be inserted, when it is too large, it is to be brought down with a brass file or rasp; and if it be too little, it is managed with a drill and other instruments used by lapidaries.

Mosaic-work of marble is used in large works, as in pavements of churches, basilics, and palaces; and in the incrustation and vanecring of the walls of the same edifices.

As for that of precious stones, it is only used in small works, as ornaments for altar-pieces, tables for rich cabinets, precious stones being so very dear.

*Manner of performing MOSAIC WORK of gypsum.* Of this stone calcined in a kiln, and beaten in a mortar, and sifted, the French workmen make a sort of artificial marbles, imitating precious stones; and of these they compose a kind of mosaic-work, which does not come far short either of the durability or the vivacity of the natural stones; and which besides has this advantage, that it admits of continued pieces or paintings of entire compartments without any visible joining.

Some make the ground of plaster of Paris, others of

free stone. If it be of plaster of Paris, they spread it in a wooden frame, of the length and breadth of the work intended, and in thickness about an inch and a half. This frame is so contrived, that the tenons being only joined to the mortises by single pins, they may be taken asunder, and the frame be dismounted, when the plaster is dry. The frame is covered on one side with a strong linen cloth, nailed all round, which being placed horizontally with the linen at the bottom, is filled with plaster passed through a wide sieve. When the plaster is half dry, the frame is set up perpendicularly, and left till it is quite dry; then it is taken out, by taking the frame to pieces.

In this mosaic, the ground is the most important part. Now in order to the preparation of this sifted gypsum, which is to be applied on this ground, it is dissolved and boiled in the best English glue, and mixed with the colour that it is to be of; then the whole is worked up together into the usual consistence of plaster, and then is taken and spread on the ground five or six inches thick. If the work be such, as that mouldings are required, they are formed with gouges and other instruments.

It is on this plaster, thus coloured like marble or precious stone, and which is to serve as a ground to a work, either of lapis, agate, alabaster, or the like, that the design to be represented is drawn; having been first pounced or calqued. To hollow or impress the design, they use the same instruments that sculptors do; the ground whereon they are to work not being much less hard than the marble itself. The cavities being thus made in the ground, are filled with the same gypsum boiled in glue, only differently coloured, and thus are the different colours of the original represented. In order that the necessary colours and tints may be ready at hand, the quantities of the gypsum are tempered with the several colours in pots.

After the design has been thus filled and rendered visible, by half-polishing it with brick and soft stone, they go over it again, cutting such plates as are either to be weaker or more shadowed, and filling them with gypsum; which work they repeat, till all the colours being added one after the other, represent the original to the life.

When the work is finished, they scour it with soft stone, sand, and water; after that, with a pumice-stone; and in the last place polish it with a wooden muller and emery. Then, lastly, they give it a lustre, by smearing it over with oil, and rubbing it a long time with the palm of the hand, which gives it a lustre no ways inferior to that of natural marble.

**MOSAMBIQUE**, the capital of a province of the same name in Zanguebar, in Africa, situated on an island at the mouth of the river Mosambique: E. lon. 40°. S. lat. 15°.

**MOSCHUS**, a genus of quadrupeds of the order of pecora, having no horns; the canine teeth of the upper jaw are exerted. There are three species, viz. 1. The moschiferus, or musk animal, has a bag or pellicle near the navel, in which the perfume called musk is contained.

This creature, when full grown, is three feet in length, from the tip of the nose to the rump; the head is oblong, and the anterior part much like the greyhound; the ears are large and erect, they resemble those of the rabbit, and are equal in length to the diameter of the forehead; the tail is not more than two inches in length, and the creature always carries it erect; the body is tolerably fleshy, and rounded; the legs about a foot in length, and very robust; the feet deeply divided, each into two claws in the anterior part, and as many heels behind. The fur on the head and that on the legs is about half an inch long, that on the belly is an inch and a half, and that which grows on the back three inches; these hairs are thicker than in any other known animal, and are variegated, from the base to the extremity, with distinct spaces of brown and white. The vesicle or bag in which the perfume called musk is contained, is three inches long and two broad, and hangs under the belly, protuberating near three quarters of an inch beyond the surface. It is a native of Tartary.—2. The grimmia has a protuberant belt upon its head, and is found in Africa. 3. The pygmaeus has feet narrower than a man's finger. It is found in Asia and Guinea.

**MOSCOW**, the capital of the province of the same name in Muscovy, situated on the river Moscowa, 360 miles south-east of Petersburg: E. long. 38°, N. lat. 55° 45'.

**MOSCOWA**, a river which rises in the west part of the province of Moscow, and falls into the river Ocka at Kolomna.

**MOSELLE**, a river of Germany, which rises in the mountains of Vauge, in Lorraine, and, running thro' that duchy and the electorate of Triers, falls into the Rhine at Coblentz.

**MOSKITO**, a country of North America, situated between 85° and 88° of west longitude, and between 13° and 15° of north latitude; having the north sea on the north and east, Nicaragua on the south, and Honduras on the west.

**MOSPURG**, or **MOSBURG**, a town of Germany, in the circle of Bavaria, situated at the confluence of the rivers Iser and Amburg, thirty miles north-east of Munich.

**MOSQUE**, a temple, or place of religious worship, among the Mahometans.

All mosques are square buildings, generally built with stone. Before the chief gate there is a square court, paved with white marble; and low galleries round it, whose roof is supported by marble pillars. In these galleries the Turks wash themselves before they go into the mosque. In each mosque there is a great number of lamps; and between these hang many crystal rings, ostriches eggs, and other curiosities, which when the lamps are lighted make a fine shew. As it is not lawful to enter the mosques with shoes or stockings on, the pavements are covered with pieces of stuff sewed together, each being wide enough to hold a row of men kneeling, sitting, or prostrate. The women are not allowed to enter the mosque, but stay in the porches without. About every mosque

there are six high towers, called minarets, each of which has three little open galleries, one above another: these towers, as well as the mosques, are covered with lead, and adorned with gilding and other ornaments; and from thence, instead of a bell, the people are called to prayers by certain officers appointed for that purpose. Most of the mosques have a kind of hospital belonging to them, in which travellers, of what religion soever, are entertained during three days. Each mosque has also a place called Tarbe, which is the burying-place of its founders; within which is a tomb six or seven feet long, covered with green velvet or fatten; at the ends of which are two tapers, and round it several seats for those who read the koran and pray for the souls of the deceased.

**MOSS**, in botany. See **MUSCUS**.

**Moss** is also a name given to boggy grounds in many parts of the kingdom. These consist of a turfy surface, below which is a black, moist, spongy earth, which being dug up with spades somewhat in the form of bricks, and dried, is what they call peats, used as fuel in several parts; and the upper scurf, being cut and dried, makes turfs, another coarser sort of fuel.

**MOSTRA**, in the Italian music, a mark at the end of a line or space, to shew that the first note of the next line is in that place: and if this note be accompanied with a sharp or flat, it is proper to place these characters along with the mostra.

**MOTACILLA**, in ornithology, a genus of birds, of the order of the passeris, distinguished by a straight beak, of a subulated figure, and a lacerated tongue. There are 49 species belonging to this genus, most of which feed upon insects, and migrate from the north to the southern countries in order to procure subsistence in winter.

**MOTE**, in law-books, signifies court or convention; as a ward-mote, burgh-mote, swain-mote, &c.

**MOTH**, in zoology. See **PHALÆNA**.

**MOTHER**, a term of relation, denoting a woman who hath born a child.

**MOTION**, is defined to be the continued and successive change of place. See **MECHANICS**.

**MOTTO**, in armoury, a short sentence or phrase carried in a scroll, generally under, but sometimes over the arms; sometimes alluding to the bearing, sometimes to the name of the bearer, and sometimes containing whatever pleases the fancy of the deviser.

**MOVEABLE**, in general, denotes any thing capable of being moved.

**MOVEABLE Subject**, in Scots law, any thing that moves itself, or can be moved; in contradistinction to immoveable or heretable subjects, as lands, houses, &c. See **LAW**, Tit. ix. 2.

**MOVEMENT**, in mechanics, a machine that is moved by clock-work. See **WATCH**.

**Perpetual MOVEMENT**. Some have attempted to find a perpetual movement, but without success; and there is reason to think, from the principles of mechanics, that such a movement is impossible: for though in many cases of bodies acting upon one another, there is a

gain of absolute motion; yet the gain is always equal in opposite directions, so that the quantity of direct motion is never increased.

To make a perpetual movement it appears necessary, that a certain system of bodies, of a determined number and quantity, should move in a certain space for ever, and in a certain way and manner: and for this there must be a series of actions returning in a circle, otherwise the movement will not be perpetual; so that any action by which the absolute quantity of force is increased, of which there are several sorts, must have its corresponding counter-action, by which the gain of force is destroyed, and the quantity of force restored to its first state.

Thus, by these actions, there will never be any gain of direct force, to overcome the friction and the resistance of the medium; so that every motion being diminished by these resistances, they must at length languish and cease.

**MOULD**, or **MOLD**, in the mechanic arts, &c. a cavity cut with a design to give its form or impression to some softer matter applied therein, of great use in sculpture, foundery, &c.

**MOULD**, in agriculture, a loose kind of earth, every where obvious on the surface of the ground, called also natural or mother earth; by some also loam.

**MOULDINESS**, a term applied to bodies which corrupt in the air, from some hidden principle of humidity therein; and whose corruption shews itself by a certain white down, or lanugo, on their surface, which, viewed through a microscope, appears like a kind of meadow, out of which arise herbs and flowers, some only in the bud, others full blown, and others decayed, each having its root, stalk, and other parts.

**MOULDING**, any thing cast in a mould, or that seems to have been so, though in reality it were cut with a chissel, or the ax.

**MOULDINGS**, in architecture, projectures beyond the naked wall, column, wainscot, &c. the assemblage of which forms corniches, door-cases, and other decorations of architecture. See **ARCHITECTURE**.

**MOULINET**, is used, in mechanics, to signify a roller, which being crossed with two levers, is usually applied to cranes, capstans, and other sorts of engines of the like nature, to draw ropes, and heave up stones, &c.

**MOULINET** is also a kind of turnstile, or wooden cross, which turns horizontally upon a stake fixed in the ground; usually placed in passages to keep out horses, and to oblige passengers to go and come one by one. These moulinets are often set near the outworks of fortified places at the sides of the barriers, through which people pass on foot.

**MOUND**, a term used for a bank or rampart, or other fence, particularly that of earth.

**MOUND**, in heraldry, a ball or globe with a cross upon it, such as our kings are usually drawn with, holding it in their left hand, as they do the sceptre in the right.

**MOUNT**, an elevation of earth, called also mountain. See **MOUNTAIN**.

**MOUNT ST MICHAEL**, a borough-town of Cornwall,

situated on a bay of the English channel, called Mount-bay, eighteen miles west of Falmouth.

It sends two members to parliament.

**MOUNT-SORREL**, a market town of Leicestershire, seven miles north of Leicester.

**MOUNT of Piety**, certain funds or establishments in Italy, where money is lent out, on some small security. We had also mounts of piety in England, raised by contribution for the benefit of people ruined by the extortions of the Jews.

**MOUNTAIN**, a part of the earth, rising to a considerable height above the level of the surface thereof.

**MOUSE**, in zoology. See **MUS**.

**MOUSE-EAR**, in botany. See **HIERACHIUM**.

**MOUSE-TAIL**. See **MYOSURUS**.

**Dor-MOUSE**. See **SOREX**.

**Sea-MOUSE**. See **APHRODITA**.

**MOUSEL**, or **MOSUL**, a city of Asiatic Turkey, in the province of Diarbec, or Mesopotamia, situated on the river Tigris, opposite the place where Nineveh stood; E. long. 43°, and N. lat. 36°.

**MOUTH**, in anatomy. See **ANATOMY**, p. 299.

**MOUTH** is used in the courts of princes, for what relates to their eating and drinking: Hence officers of the mouth, yeomen of the mouth.

**MSCYSLAW**, the capital of the palatinate of Mscyslaw in Poland, situated on the frontiers of Muscovy: E. long. 31° 30', and N. lat. 54° 34'.

**MUCILAGE**, in pharmacy, is in general any viscid and glutinous liquor.

**MUCILAGE** also imports the liquor which principally serves to moisten the ligaments and cartilages of the articulations; and is supplied by the mucilaginous glands.

**MUCOR**, in botany, a genus of the cryptogamia fungi class. It consists of small bladders, containing numerous seeds. There are twelve species, seven of them natives of Britain.

**MUCRO CORDIS**, in anatomy, the lower or pointed end of the heart.

**MUCUS**, a mucilaginous liquor separated by the mucous glands and the nostrils. See **ANATOMY**.

**MUER**, a town of Germany, in the circle of Austria, and duchy of Stiria, situated on the river Muer, twenty-five miles north west of Gruz.

**MUFFLE**, in Chemistry. See **CHEMISTRY**, p. 109.

**MUFTI**, the chief of the ecclesiastical order, or primate of the musselman religion. The authority of the mufti is very great in the Ottoman empire; for even the sultan himself, if he would preserve any appearance of religion, cannot, without hearing his opinion, put any person to death, or so much as inflict any corporal punishment. In all actions, especially criminal ones, his opinion is required, by giving him a writing, in which the case is stated, under feigned names; which he subscribes with the words, *He shall, or shall not be punished*. Such outward honour is paid to the mufti, that the grand seignior himself rises up to him, and advances seven steps to meet him, when he comes into his presence. He alone has the honour of kissing the sultan's left shoulder, whilst the prime vizier kisses only,

- only the hem of his garment. When the grand seignior addresses any writing to the mufti, he gives him the following titles, "To the efad, the wifeft of the wife, instructed in all knowledge, the most excellent of excellents, abstaining from things unlawful, the spring of virtue and true science, heir of the prophetic doctrines, resolver of the problems of faith, revealer of the orthodox articles, key of the treasures of truth, the light to the doubtful allegories, strengthened with the grace of the supreme legislator of mankind, may the most high God perpetuate thy virtues." The election of the mufti is solely in the grand seignior, who presents him with a vest of rich fables, &c. If he is convicted of treason, or any great crime, he is put into a mortar, kept for that purpose in the Seven Towers at Constantinople, and pounded to death.
- MUGGLETONIANS**, a religious sect which arose in England, about the year 1657; so denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his associate Reeves, set up for great prophets, pretending, as it is said, to have an absolute power of saving and damning whom they pleased; and giving out that they were the two last witnesses of God that should appear before the end of the world.
- MUGIL**, in ichthyology, a genus of fishes belonging to the order of abdominales. The lips are membranaceous, the inferior one being carinated inwards; they have no teeth; the branchiostegé membrane has seven crooked rays; the opercula are smooth and round; and the body is of a whitish colour. There are two species distinguished by the number of rays in the back-fin.
- MUG-WORT**, in botany. See **ARTEMISIA**.
- MUID**, a large measure, in use among the French, for things dry. The muid is no real vessel used as a measure, but an estimation of several other measures, as the septier, mine, minot, bushel, &c.
- MUID**, is also one of the nine casks, or regular vessels used in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter-muids, and eight half-quarter-muids, containing 36 septiers.
- MULL**, one of the western islands of Scotland, being part of the shire of Argyle, and lying to the westward of it: this island is twenty-four miles long, and in some places as many broad.
- MULL of Cantire**, the south cape or promontory of the county of Cantire or Mul, in the frith of Clyde, on the west of Scotland.
- MULL of Galloway**, the south cape or promontory of all Scotland, in the county of Galloway, on the Irish sea.
- MULATTO**, a name given in the Indies to those who are begotten by a negro man on an Indian woman, or an Indian man on a negro woman.
- MULBERRY**, in botany. See **MORUS**.
- MULCT**, a fine of money laid upon a man who has committed some fault or misdemeanor.
- MULDAW**, a river of Bohemia, that arises on the confines of Austria, and running north, through Bohemia, unites with the Elbe at Melnick.
- MULE**, in zoology, a mongrel kind of quadruped, usually generated between an ass and a mare, and sometimes between a horse and a she-ass.
- MULLERAS**, a town of Germany, in the circle of Upper Saxony, and marquifate of Brandenburg, situated thirty-eight miles south-east of Berlin.
- MULLET**, in ichthyology. See **MUGIL**.
- MULLET**, or **MOLLET**, in heraldry, a bearing in form of a flat, or rather of the rowel of a spur, which it originally represented.
- The mullet has but five points; when there are six it is called a star; though others make this difference, that the mullet is, or ought to be, always pierced, which a star is not. See plate CVI. The mullet is usually the difference or distinguishing mark for the fourth son, or third brother, or house; though it is often borne alone, as coat armour.
- MULSUM**, a liquor made of wine and honey, or even of wine and water.
- MULTAN**, or **MOULTAN**, a city of hither India in Asia, capital of the province of Multan, situated on the river Indus. E. long. 72° 15', N. lat. 30°.
- MULTIPLE**, in arithmetic, a number which comprehends some other several times, thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3, comprehending the first twice, the second thrice, &c.
- Action of MULTIPLEPOINDING*, in Scots law. See **LAW**, Tit. xxx. 24.
- MULTIPLICAND**, in arithmetic. See **ARITHMETIC**, p. 371.
- MULTIPLICATION**, in general, the act of increasing the number of any thing.
- Multiplication in arithmetic, is a rule by which any given number may be speedily increased, according to any proposed number of times. See **ARITHMETIC**, p. 371.
- MULTIPLICATION**, in algebra. See **ALGEBRA**, p. 81.
- MULTIPLICATOR**, or **MULTIPLIER**, in arithmetic. See **ARITHMETIC**, p. 371.
- MULTIPLYING GLASS**, in optics, one wherein objects appear increased in number. See **OPTICS**.
- MULTURE**, in Scots law, the quantity of grain paid to the proprietor or tackman of a mill for grinding. See **LAW**, Tit. xvi. 12.
- MULVIA**, a river of Barbary, in Africa, which rises in the mountains of Atlas, and divides the empire of Morocco from the kingdom of Algiers, and then falls into the Mediterranean, west of Marfalquiver.
- MUM**, a kind of malt-liquor, much drank in Germany; and chiefly brought from Brunswick, which is the place of most note for making it. The process of brewing mum, as recorded in the town-house of that city, is as follows: Take sixty-three gallons of water that has been boiled till one third part is consumed, and brew it with seven bushels of wheaten malt, one bushel of oat-meal, and one bushel of ground beans; when it is tunned, the hogthead must not be filled too full at first: as soon as it begins to work, put into it three pounds of the inner rind of fir, one pound of the tops of fir and beech, three handfuls of cardus benedictus, a handful or two of the flower of rosa solis; add burnet, betony,

betony, marjoram, avens, penny royal, and wild thyme, of each a handful and a half; of elder flowers, two handfuls or more; seeds of cardamum bruised, thirty ounces; barberries bruised, one ounce; when the liquor has worked a while, put the herbs and seeds into the vessel; and, after they are added, let it work over as little as possible; then fill it up: lastly, when it is stopped, put into the hoghead ten new-laid eggs unbroken; stop it up close, and drink it at two years end. Our English brewers, instead of the inner rind of fir, use cardamum, ginger, and saffras; and also add elecampane, madder, and red sanders. Mum, on being imported, pays for every barrel 1 l. 5 s.

**MUMMY**, a body embalmed or dried, in the manner used by the ancient Egyptians; or the composition with which it is embalmed. There are two kinds of bodies denominated mummies: the first are only carcases dried by the heat of the sun, and by that means kept from putrefaction: These are frequently found in the sands of Lybia. Some imagine, that these are the bodies of deceased people buried there on purpose to keep them entire without embalming; others think they are the carcases of travellers, who have been overwhelmed by the clouds of sand raised by the hurricanes frequent in those deserts. The second kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians deposited their dead after embalming.

We have two different substances preserved for medicinal use under the name of mummy, though both in some degree of the same origin. The one is the dried and preserved flesh of human bodies, embalmed with myrrh and spices; the other is the liquor running from such mummies, when newly prepared, or when affected by great heat or damps. The latter is sometimes in a liquid, sometimes of a solid form, as it is preserved in vials well stopped, or suffered to dry and harden in the air. The first kind of mummy is brought to us in large pieces, of a lax and friable texture, light and spongy, of a blackish brown colour, and often damp and clammy on the surface: it is of a strong but disagreeable smell. The second kind of mummy, in its liquid state, is a thick, opaque, and viscous fluid, of a blackish colour, but not disagreeable smell. In its indurated state, it is a dry solid substance, of a fine shining black colour, and close texture, easily broken, and of a good smell; very inflammable, and yielding a scent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy used in the shops; but it is very scarce and dear; while the other is so cheap, that it will always be most in use.

All these kinds of mummy are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptian mummies, to sell them in pieces to the druggists, as they may make a much better market of them in Europe whole, when they can contrive to get them. What our druggists are supplied with, is the flesh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen so plentiful in that part of the world; and adding

a little aloes, and two send them to be baked in exhaled, and the embalming thoroughly that the flesh will keep and bear transporting into Europe. Mummy has been esteemed resolvent and balsamic: but whatever virtues have been attributed to it, seem to be such as depend more upon the ingredients used in preparing the flesh, than in the flesh itself; and it would surely be better to give those ingredients without so shocking an addition.

**MUMMY**, among gardeners, a kind of wax used in grafting and planting the roots of trees, made in the following manner: Take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and set them on fire in the open air, holding something in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the composition is then to be set by for use.

**MUNGATS**, or **MUNKATS**, a town of upper Hungary: E. long. 22°, N. lat. 48° 30'.

**MUNICH**, a large and elegant city, the capital of the electorate and duchy of Bavaria situated on the river Iser: E. long. 11° 32', N. lat. 48° 5'.

**MUNICIPAL**, in the Roman civil law, an epithet which signifies invested with the rights and privileges of Roman citizens. Thus the municipal cities were those whose inhabitants were capable of enjoying civil offices in the city of Rome: These cities, however, according to Mariana, had fewer privileges than the colonies: They had no suffrages or votes at Rome; but were left to be governed by their own laws and magistrates. Some few municipal cities, however, obtained the liberty of votes:

Municipal, among us, is applied to the laws that obtain in any particular city or province. And those are called municipal officers who are elected to defend the interest of cities, to maintain their rights and privileges, and to preserve order and harmony among the citizens; such as mayors, sheriffs, consuls, &c.

**MUNITION**, the provisions with which a place is furnished in order for defence; or that which follows a camp for its subsistence.

**MUNSTER**, the capital of the bishoprick of the same name, and of the circle of Westphalia, situated on the river Aa: E. long. 7° 10', N. lat. 52°.

**MUNSTER**, is also a town of Germany, in the Landgraviate of Alsatia, subject to France: E. long. 7° 5', N. lat. 48° 8'.

**MUNSTER MEINFELT**, a town of Germany, in the circle of the lower Rhine, and electorate of Triers: E. long. 7°, N. lat. 50° 15'.

**MUNSTERBERG**, the capital of the duchy of the same name in Silesia: E. long. 16°, N. lat. 50° 35'.

**MUNTINGIA**, in botany, a genus of the polyandria monogynia class. The calix consists of five segments, and the corolla of five petals; and the berry has one cell containing many seeds. There is but one species, a native of America.

ogy, a genus of fishes  
The head is smooth;  
the membrane of the gills; the  
eyes are covered with a common skin; and the body  
is cylindrical, and slimy. There are seven species,  
distinguished by their fins, tail, &c.

MURCIA, the capital of the province of the same name  
in Spain: W. long. 1° 12', N. lat. 38° 6'.

MURDER, or MURDER, in law, is the wilful and  
felonious killing a person from premeditated malice;  
provided the party wounded, or otherwise hurt, die  
within a year and a day after the fact was committed.  
See LAW, Tit. xxxiii.

MURDERERS, or MURDERING-PIECES, in a ship, are  
small pieces of ordnance, either of brass or iron, which  
have chambers, put in at their breeches. They are  
used at the bulk-heads of the fore-castle, half-deck, or  
steerage, in order to clear the deck, on the ship's being  
boarded by an enemy.

MURRENGERS, two officers of great antiquity in the  
city of Chester, annually chosen out of the aldermen,  
to see that the walls are kept in repair, and to receive  
a certain toll and custom for the maintenance thereof.

MUREX, in zoology, a genus of insects belonging to  
the order of vermes testacea. This animal is of the snail  
kind; and the shell consists of one spiral valve, rough  
with membranaceous furrows; and the aperture terminates  
in an entire canal either straight or somewhat ascend-  
ing. There are 60 species, particularly distinguished  
by peculiarities in their shells, &c.

MURIA, ALIMENTARY SALT. See SALT.

MURO, a town of Italy, in the kingdom of Naples,  
sixty miles south-east of the city of Naples.

MURRAIN, or GARGLE, a contagious disease among  
cattle.

The symptoms of this disease are a hanging down  
and swelling of the head, abundance of gum in the eyes,  
rattling in the throat, a short breath, palpitation at the  
heart, staggering, a hot breath, and a shining tongue.

In order to prevent this disease, the cattle should  
stand cool in summer, have plenty of good water; all  
carriage should be speedily buried; and as the feeding  
of cattle in wet places, on rotten grass and hay, often  
occasions this disease, dry and sweet fodder should be  
given them.

MURRAY, a county of Scotland, bounded by the German  
Sea, on the north; by Banff, on the east; by Mar and  
Badenoch, on the south; and by Inverness, on the west.

MURREY, in heraldry, a kind of purple colour. See  
SANGUINE.

MUS, in zoology, a genus of quadrupeds, belonging to  
the order of glires; the generic character of which is,  
that the fore-teeth of the lower jaws are subulated.  
There are 21 species. 1. The porcellus, or guiney-  
pig, has no tail; there are four toes on the fore-feet,  
and three on the hind ones. This animal makes a  
grunting noise, is very restless, and stamps with its  
hind-feet when teased. It loves heat, and feeds upon  
various vegetables. The female has two dugs.  
The colour is very various. It is a native of Brazil.  
2. The agati has a short tail, four toes on the fore-

feet, three on the hind ones, and a yellowish belly.  
It is a native of Brazil, Surinam, and Guinea. 3.  
The leporinus has the same characters with the former;  
only the belly is white. It is found in Java and Su-  
matra. 4. The citellus has a short tail, an ash-  
coloured body, and no ears. It is found in Bohemia,  
&c. below ground. 5. The lemmus, has a short tail,  
five toes on both fore and hind-feet, and the body is  
variegated with green and yellow. They are found in  
the Lapland mountains under little hillocks, and feed  
solely on vegetables. 6. The paca, has a short tail,  
five toes on each foot, and there are three yellowish  
lines on each side. It is a native of Brazil. 7. The  
marmota has a short hairy tail, round ears, and gib-  
bous cheeks. It digs deep holes in the earth with a-  
mazing quickness; sleeps profoundly during the win-  
ter; lifts its food to its mouth with the fore-feet; of-  
ten sits erect; it is easily tamed, and is found in Swit-  
zerland. 8. The monax has a hairy tail, an ash-  
coloured body, roundish ears, and four toes on the fore  
feet and five on the hind ones. It is a native of Ame-  
rica. 9. The cricetus has a tail of a moderate length,  
round ears, a black belly, and reddish sides, with three  
white spots. This animal digs deep caverns in the  
earth, divided into many different cells in which it  
deposits and preserves large quantities of fruits and  
grains. The female brings forth six young ones twice  
in the year, each of which lives in a separate cell.  
They are hunted for food, for their skins, and even  
for the quantity of grain found in their cells. It is a  
native of Germany. 10. The terrestris has a hairy  
tail, with four toes on the fore-feet, and five on the  
hind ones, and ears shorter than the hair. This ani-  
mal, which is about half the size of a rat, digs in the  
gardens like a mole, and eats the bark off the roots of  
trees, &c. It swims in ditches, and devours young  
ducks in the ponds. It is a native of Europe. 11.  
The amphibious has a long hairy tail, with palmated  
feet. It digs in the banks of ditches and under the  
roots of trees, and feeds upon vegetables. It is found  
both in Europe and Africa. 12. The rattus, or rat,  
has a long naked tail, four toes on the fore-feet, and  
five on the hind ones, and a claw on the large toe.  
This animal infests the houses every where through  
Europe, and is devoured by cats and other animals  
of the same class. It is reported by several authors,  
that rats were originally transported from America in  
a ship belonging to Antwerp. 13. The musculus, or  
common mouse, has a long naked tail, four toes on  
the fore-feet and five on the hind ones, but has no  
claw on the large toe. This animal is a native of  
Europe, feeds upon grain and fish of all kinds. 14.  
The avellanarius has a long hairy tail, a reddish-  
body, a white throat, and the hind toes have no claws.  
It frequents the woods of Europe, feeds upon nuts,  
which it lays up in the earth, and sleeps during win-  
ter. 15. The quercinus has a long hairy tail, with a  
black ring under the eyes. It is a native of the south  
of Europe. 16. The gregarius has a tail about one  
third of the length of its body, and somewhat hairy;  
the body is of a greyish colour, and the legs are white.

It is a native of Germany. 17. The sylvaticus has a tail of a middling length, four toes on the fore feet, and five on the hind ones; the body is grey, interspersed with black hairs, and the belly is white. It is found in the gardens and woods of Europe. 18. The striatus has four toes on the fore-feet, and five on the hind ones; it has longitudinal streaks on the body, with white spots. It is a native of India. 19. The longipes has a long covered tail, four toes on the fore feet, five on the hind ones, and very long thighs. It is found in the torrid zone. 20. The jaculus has a long fleecy tail, with very long thighs, and short fore-legs. It walks on its hind-feet only, and has a jumping motion. It is found in Arabia, Egypt, &c. 21. The volans has a long hairy tail, four toes on the fore feet and five on the hind ones, and the skin from the ears to the tail is extended like wings, by which it is enabled to fly. It is a native of Virginia and Mexico.

MUSA, the PLAIN-TREE, in botany, a genus of the polygamia monœcia class. The calix is a spathe: the corolla consists of two petals; one of them straight and toothed; and the other is concave, short, and furnished with a nectarium. It has six filaments, and one stylus. There are four species, all natives of the Indies.

MUSCA, in zoology, a genus of insects belonging to the order of diptera. The mouth is furnished with a fleshy proboscis, and two lateral lips; it has no pappi. There are 129 species, principally distinguished by peculiarities in their feelers.

MUSCADINE, a rich kind of wine, of the growth of Provence and Languedoc, in France.

MUSCLE, in anatomy. See ANATOMY, p. 192.

MUSCLE, in natural history. See MYTULUS.

MUSEUM, a name which originally signified a part of the palace of Alexandria, which took up at least one fourth of that city. This quarter was called the Museum, from its being set apart for the muses and the study of the sciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the sciences of which they were the professors; and to each of these houses or colleges was allotted a handsome revenue. The foundation of this establishment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word Museum is now applied to any place set apart as a repository for things that have an immediate relation to the arts.

The Museum at Oxford, called the Ashmolean Museum, is a noble pile of building, erected at the expense of the university, at the west end of the theatre,

at which side it has a magnificent portal, sustained by pillars of the Corinthian order. The front, which is to the street, extends about sixty feet, where there is this inscription over the entrance, in gilt characters, *Museum Ashmoleanum, schola naturalis historie, officina chymica.*

It was begun in 1679, and finished in 1683, when a valuable collection of curiosities was presented to the university by Elias Ashmole, Esq. which were the same day deposited there. And several accessions have been since made to the Museum; among which are hieroglyphics and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curiosities.

The British Museum in London is a large, beautiful, and magnificent building, and the noblest cabinet of curiosities in the world. This edifice was erected in 1677, and was called Montague-house, from having been the town residence of the dukes of Montague. In the year 1753, the British parliament having passed an act for purchasing the Museum of the late Sir Hans Sloane, and the collection of manuscripts of the late lord Oxford, called the Harleian Library, for the use of the public; 26 trustees were appointed and incorporated, to provide a repository for those and some other collections, which repository was to be called the British Museum. These trustees elected fifteen other trustees; and having bought Montague-house, fitted it up for the reception of these collections: they also appointed officers to superintend the museum; and having ordained certain statutes with respect to viewing the collection contained in it, the public were admitted to view it in 1757.

MUSES, certain fabulous divinities amongst the pagans, supposed to preside over the arts and sciences: for this reason it is usual for the poets, at the beginning of a poem, to invoke these goddesses to their aid. Some reckon the muses to be no more than three, *viz.* Mneme, Aœde, and Melete; that is, memory, singing, and meditation: but the most ancient authors, and particularly Homer and Hesiod, reckon nine; *viz.* Clio, which means glory; Euterpe, pleasing; Thalia, flourishing; Melpomene, attracting; Terpsichore, rejoicing the heart; Erato, the amiable; Polyhymnia, a multitude of songs; Urania, the heavenly; and Calliope, sweetness of voice. To Clio, they attributed the invention of history; to Melpomene, tragedy; to Thalia, comedy; to Euterpe, the use of the flute; to Terpsichore, the harp; and to Erato, the lyre and lute; to Calliope, heroic verse; to Urania, astrology; and to Polyhymnia, rhetoric.

MUSHROOM, in botany. See FUNGUS.

## M U S I C K.

MUSICK is one of the seven sciences commonly called liberal; and is comprehended also among the mathematical, as having for its object discrete

quantity or number, but not considering it in the abstract-like arithmetick, but in relation to time and sound, in order to make a delightful harmony: Or it is the art of disposing,

disposing and conducting sounds considered as acute and grave; and proportioning them among themselves, and separating them by just intervals pleasing to the sense.

Mr Malcome defines it a science that teaches how sound, under certain measures of time and tune, may be produ-

ced; and so ordered and disposed, as either in consonance (*i. e.* joint-sounding,) or succession, or both, they may raise agreeable sensations.

From this definition, the science naturally divides into two general parts, *viz.* theoretical and practical.

## PART I. THE THEORY OF MUSICK.

### CHAP. I. OF MUSICAL SOUNDS.

**AXIOM I.** The ear is the sole judge of sound. Every sound is not a musical sound. For to this two things are required: first, That the sound please the ear; secondly, That it be within a certain compass. A musical sound is clear, uninterrupted; and uniform; and ought not to exceed the power of the ear to judge of it.

For sounds, very deep or very high, are not easily distinguished, but by an ear very conversant in musick.

Sound being a simple idea, cannot be defined but by an imperfect description of its cause; which is an undulatory motion of the air, communicated by the vibration of the parts of bodies to the organ of hearing.

The diversities of sounds, and their proportions, are perfectly discerned by the ear, are the object of the theory of musick, the grounds and principles of the practice, as well as the causes of pleasure in the sense and imagination.

These diversities of sounds are expressed by the terms high and low, acute and grave, or sharp and flat. Hence, from any given sound, we can conceive a succession of them; wherein the last in order is more acute than the foregoing; and this series is called notes ascending.

Or, on the contrary, when, in a succession of sounds, the last in order is more grave than the former; this series is called notes descending.

**AXIOM II.** From this order of notes ascending and descending are deduced all the proportions of sounds; the properties of the same proportions; and the relations which arise out of their various combinations and successions. These include the whole business of harmony and melody; and the knowledge of them is the ground work or basis of the science of musick.

**COROLLARY I.** Hence nothing can be admitted in musical composition which doth not immediately depend on the foregoing axiom, and which cannot be demonstrated from it.

#### SECT. 2. Of the DIVERSITY of SOUNDS.

THE diversity of sounds succeeding in the natural order is not however extended through any number of sounds which may be expressed by a musical instrument, or even by the human voice. For universal experience, conducted by the judgment of the ear, hath demonstrated and ascertained the number seven to comprehend all the variety that musick is capable of affording. Therefore, the number eight is the bound or limit of the materials of musical composition; and this eighth note or sound is called an octave.

This octave may be conceived as unity, or the first note of another series ascending or descending.

This series, though it may be repeated at pleasure, must still come under the restriction above mentioned; which is, that it must not exceed the power of the ear to judge of it. The greatest compass of the human voice will scarcely reach above two octaves, or fifteen notes. Instruments are framed with more, to answer the most interesting purpose of musick, which is variety.

The seven sounds in music are named from the first seven letters of the alphabet, *viz.* A, B, C, D, E, F, G.

The distance between any two of those, whether immediate or remote, is called an interval. And every interval is named from the natural numbers; beginning at unity.

In naming of an interval, it is always understood of the ascending notes; and both terms are inclusive. Thus AB is called a 2d, AE a 5th, BE a 4th, EG a 3d, AA an 8th or octave; and so of the rest.

We proceed now to lay down an exact description of all the intervals in music. For from the knowledge of these are discovered all the proportions which constitute harmony; and upon which the whole superstructure of musick is raised.

First, of the intervals of sounds lying in their natural order. Of these there are seven intervals, named either the greater tone, the lesser tone, and the half-tone or semitone. See the *Musick Plates*, N<sup>o</sup>. 1, 2.

		Interval of a						
		Major	Minor	Semitone	Major	Minor	Major	Semitone
N <sup>o</sup> . 1.		Major	Minor	Semitone	Major	Minor	Major	Semitone
		Interval of a						
		Major	Semitone	Minor	Major	Semitone	Minor	Major
N <sup>o</sup> . 2.		Major	Semitone	Minor	Major	Semitone	Minor	Major

In this series of 8 notes are contained 5 whole tones; three greater, and two lesser; and 2 semitones. Reducing them therefore to the lowest denomination, they will be found to contain 12 half-tones; and inclusively 13. Every octave then contains 13 half tones; out of the various combinations of which arise the several concords and discords, as will be shewn in its proper place. The lesser tones are alike divided into half tones, as are the greater. We shall therefore, for brevity sake, hereafter use the distinction only of whole tones and half tones: the reason for which shall be assigned below.

From the inequality in the order of these intervals we draw the following corollary.

Cor. II. Harmonical proportion is of a species different from all other proportions, and can be demonstrated only from principles peculiar to itself. This will be seen when we come to shew the method of dividing a line harmonically; as well as from the proportion stated in numbers.

The first of the notes in the examples above is called the key-note, or key. Notwithstanding the intervals may be reckoned from any given note; yet it will answer our purpose better to begin with the key.

In the first example,

The first interval, or distance between the key and second, contains 2

Between the 2d and 3d	2	
3d and 4th	1	
4th and 5th	2	Semitones.
5th and 6th	2	
6th and 7th	2	
7th and 8th	1	

In the second example,

The first interval, or distance between the key and second, contains 2 semitones.

Between the 2d and 3d	1	
3d and 4th	2	
4th and 5th	2	Semitones.
5th and 6th	1	
6th and 7th	2	
7th and 8th	2	

From this comparison of the two series, it is evident there is but one difference, and this arising from the order of the notes, or place of the semitone. For if you begin to read the second series at the interval between the 3d and 4th, the semitones will be found exactly in the same order as in the first example.

In the first example, the first semitone falls on the 4th note, or that which is next above the 3d to the key; which 3d is 5 half tones above the key inclusively. In the 2d example, the half-tone falls on the 3d note; and is therefore itself the third to the key, and is four half-tones above the key inclusively.

This distinction of the place of the semitone is most worthy of observation, it being the only essential difference of tune, the ground-work of all that beautiful variety which may be introduced in the air or melody, as well as it is the principle or hinge on which turns the resolution of every discord. The key-note of every tune is that whereon the tune ends; which though it may be altered for variety in the upper part, yet the last note of the bass is ever the key.

When the 3d to the key is 5 semitones to the key, as in the first example, that tune is said to be composed in a sharp key. When the 3d to the key is 4 semitones to the key, as in the second example, the tune is in a flat key. And this, as was said before, is the only difference in tune.

This distinction of flat and sharp third holds good, not only in relation to the key, but likewise to every note in the scale of musick. And in this light it is the foundation of composing in different keys; of changing the key in the same tune which introduces the so much desired variety in musick; and of writing the same tune in

divers keys, which is called transposition. Hence we establish the following axioms.

AXIOM III. As the difference of the flat and sharp third to the key constitutes the key, and is essential to the tune: so no tune composed in a sharp key can be composed into a flat one, nor a flat into a sharp; for that would be altering the permanent nature of things.

The truth of this axiom will most evidently appear, when we shall, in the second part, or practice, have learned the art of transposition.

AXIOM IV. The great and constant object which must be sought after in musick, whether in composition, or performance of thorough bass, is variety with uniformity. For the proportions already laid down, and the prodigious variety emerging from them, as they lie in the order of nature, before they are modified, divided or combined by art, do not only point out this variety to us; but the concords and discords likewise made out of these, and arranged by art, will not only not suffer us to recede from the established precept, but by a kind of sweet violence constrain us to pursue this darling object.

On the truth of this axiom is grounded the reason for the mixture of discord with harmony, and the occasion of this precept in playing thorough bass, namely, that the hands should as much as possible move in a contrary direction.

As to the place of the other semitone, which in the flat key is on the 6th, the reason shall be told in its proper place. And moreover, it must be observed, that the greater 7th in the sharp key, which causes the second semitone to fall on the 8th in that key, is also common to the flat key in many passages, but unexceptionably at the end of the tune, or close.

### Sect. 3. Of the CONCORDS and DISCORDS.

OF the intervals standing in their natural order are compounded the greater intervals, namely, the concords and discords.

These are the next things to be considered. Now, to investigate the order of these, and their proportions to each other, we must have recourse to the original cause of sound; that is, to the tremulous motion of the air, excited by the percussion of some solid body, as a bell, string, or pipe.

This trembling of the air is in proportion quick or slow as the impression given it by the voice or an instrument. The quicker the trembling is, the more acute the sound; the slower, the more grave or flat. The same sound is the effect of the same degree of quickness of the air's motion continued. Hence a string sounding the same note to the end of its vibration, proves, that the vibrations are in equal times, from the greatest to the least ranges of its motion.

The shorter a musical string is, the quicker are its vibrations, and therefore the more acute the sound.

The longer a string is, the more slow are its vibrations, and so the more grave the sound.

Therefore, from the division of a musical string, the proportions of acuteness or gravity are computed. Hence we raise the following axiom.

AXIOM V. The quickness of the vibrations is reciprocal

proportions of the lengths. Thus in two strings of the same matter, and equal diameters; if one be double the length of the other, it will give half the quickness of pulses; that is, half the number of pulses in the same time: or, the lengths being as 2 to 1, the vibrations are as 1 to 2. On this axiom are demonstrated the order and proportions of the concords, as follows.

*Proportion of the Octave.*



Let AB, a musical string, be divided equally in C, and stopt there: CB will found an octave to the whole or open string AB. Now, CB, AB, are as 1 to 2: therefore, the vibrations are as 2 to 1; that is, the proportion of the octave or diapason is double, or 2 to 1. Q. E. D.

*Proportion of the 5th.*



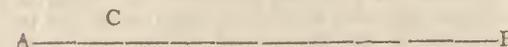
Let AB be divided into three equal parts, and stopt in C: CB will found a 5th to the whole or open string. Now, CB is to AB as 2 to 3: therefore the vibrations are as 3 to 2; that is, the proportion of the 5th, or diapente, is sesquialteral, or 3 to 2.

*Proportion of the 4th.*



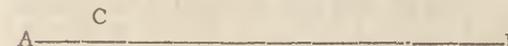
Let the string be stopt in C, which is a 4th part of the whole: CB will found a 4th to the whole AB or open string. Now, CB is to AB as 3 to 4: therefore the vibrations are as 4 to 3; or, the proportion of the 4th, or diatessaron, is 4 to 3.

*Proportion of the sharp 3d.*



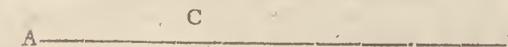
Stop the string in C, the 5th part: CB will found a greater 3d to AB. But CB is to AB as 4 to 5. Therefore the vibrations are as 5 to 4; or, the proportion of the sharp 3d is as 5 to 4.

*Proportion of the flat 3d.*



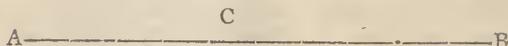
Stop in C the 6th part: CB will found the lesser or flat third. But, &c. Therefore the proportion of the flat third is as 6 to 5.

*Proportion of the greater or sharp 6th.*



CB  $\frac{2}{7}$ ths of AB will found the greater 6th. Therefore the proportion of the sharp 6th, is as 5 to 3.

*Proportion of the lesser or flat 6th.*



CB,  $\frac{3}{8}$ ths of AB, founds the lesser 6th, Therefore the proportion of the flat 6th is as 8 to 5.

If these divisions of the string, whose numerators are the same, or unity, be set down in fractions, in the natural order of numbers, thus  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}$ , &c. and reduced to a common denominator, the harmonical proportions will appear in the same succession of concords, as investigated by found in the division of the same line; and the numerators, being by this reduction as whole numbers, will stand thus, 60, 40, 30, 24, &c. For the common denominator, 120, answering to the whole or open string; the relative proportion of the same to the first fraction, and the relative proportion between each two successive fractions, will express the proportion of the harmonic chords. Thus  $\frac{1}{2}$  to  $\frac{1}{3}$  or 8th.  $\frac{60}{60} : \frac{40}{40}$  or 5th.  $\frac{60}{60} : \frac{30}{30}$  or 4th.  $\frac{60}{60} : \frac{24}{24}$  or sharp 3d. Hence we discover relative harmonical proportion in numbers: which is, As the first is to the third; so is the difference of the first and second to the difference of the second and third. For, reducing the first three numbers to the lowest terms, and inverting, they will be 2, 3, 6. Now 2:6::1:3. Again, reducing the second three, they will be 3, 4, 6. Now 3:6::1:2. Wherever this proportion obtains, the numbers bear harmonical or musical relation. Further, the rectangle, or quotient of the first and third numbers multiplied, being divided by the excess of twice the first above the second, finds a fourth proportional. Thus 3, 4, 6, given as above; 3 multiplied by 6, gives 18: which divided by 2, the excess of twice 3, the first above 4 the second, gives 9, the fourth musical proportional. Thus 3, 4, 6, 9: And of these, the first is to the fourth, as the difference of the first and second is to the difference of the third and 4th. So 3:9::1:3.

The harmonical proportion of three numbers in this natural succession of fractions, extends as far as the chord of the flat 3d. Which third, being  $\frac{1}{3}$  of the whole number, limits this equality of proportion, seeing that the number 7 is no aliquot part. But as to the fourth proportional, it cannot be found even from that number which expresses the sharp 3d, which is still of shorter extent. This limitation of proportion then explains the extent of harmony, and likewise becomes the principle of the same; as will be seen in the definition of harmony.

Hence it is evident, the remaining concords of the sharp 6th, which is  $\frac{5}{7}$ , and of the flat 6th, or  $\frac{5}{8}$ , are not included in this equality of proportion.

These are the concords, their order and proportions; any one of which sounded together with the open string, is concordant with it, and produces harmony.

Example of the names and order of the intervals in concord with the open string or bass, and the semitones contained in each, *Musick Plates*, No. 3.

Again, two of these concordant intervals, namely, the  
5th and — 8th  
Sharp 3d and — 8th

Flat

- Flat 3d and — 8th
- Sharp 3d and — 5th
- Flat 3d and — 5th
- Sharp 3d and Sharp 6th
- Flat 3d and Flat 6th
- 6th and — 4th
- Flat 6th and — 4th

founded with the open string, or bass note, are concordant all together; and therefore produce harmony.

Example of two concurring with the open string or bass. No. 4.

Next follows an example of three concurring with the bass. No. 5.

Having thus discovered the concords, their order and proportions; it is worth remarking, that the first concord, or 8th, which arises from the most simple division of a line, is the most perfect concord; the 5th is the next perfect concord; and so of the rest, in the order they have been found by the division of the string. For the nature and perfection of the 4th, accounted by some a very imperfect concord, shall be explained in the corollaries of the demonstration of the harmony, in Part II. on practice.

The 8ths and 5ths then are called the perfect concords. The 3ds and 6ths imperfect concords. The 4th, of a middle nature between the others, may be called an improper concord; for this reason, that with the 6th, with which it is always accompanied in harmony, though it make perfect harmony with the given note, yet they change the chord into that of the 4th to that note.

Likewise the 6th, whether joined with the 3d or 4th to the given note, tho' it make perfect harmony with either, yet they change the chord into that of the 6th or 4th to the same note.

Hence the reason why the 6ths are more imperfect concords than the 3ds.

From the order and perfection of the concords thus discovered; we deduce the following corollary.

COR. III. The most perfect harmony is that which will be produced by the perfect concords, namely, the 3d, 5th, and 8th. Thus No. 6.

From the foregoing corollary, we are able to give a just definition of harmony. HARMONY consists in one certain invariable proportion of distance of four sounds performed at the same instant of time, and most pleasing to the ear.

These proportions of the first series are called simple concords. If the notes of a second series be added to the first octave, the proportion of any two concurring notes compounded with the octave retains the same and nature of the simple concord; as a tenth, compounded of an octave and third, is called a third; a twelfth, compounded of an octave and 5th is called a fifth; a fifteenth, compounded of two octaves, is called an octave, or double octave. And so on to a third series.

These are the compound concords.

All other proportions founded together are harsh and disagreeable to the ear; and are for this reason called discords.

From the compounding and dividing the proportions delivered, not only the harmonical intervals are computed, but the discords likewise.

And this the following calculations demonstrate.

The proportion of the octave is the proportion of the 4th and 5th: for, by compounding  $\frac{4}{3} \times \frac{5}{4} = \frac{5}{3}$ , or  $\frac{5}{3}$  the proportion of the octave.

Again, it is the proportion of the sharp 3d and flat 6th: for,  $\frac{5}{4} \times \frac{8}{7} = \frac{40}{28} = \frac{10}{7}$  in its lowest terms.

Again, the flat 3d and sharp 6th: for,  $\frac{6}{7} \times \frac{5}{4} = \frac{30}{28} = \frac{15}{14}$  or  $\frac{5}{7}$  the proportion of the octave.

Now, since the 4th and 5th, the 3d and 6th, as also the 2d and 7th, compounded, make the octave; that is, any two numbers making 9, the middle term or note being repeated, or common to both; it follows, that to fall a 4th or rise a 5th, as also to fall a 3d or rise a 6th, and to fall a 2d or rise a 7th, and the contrary, answers the same purpose of harmony; for they meet in the octave.

This observation will be of great use in setting the bass, and figuring the same, by producing that variety and contrary motion demonstrated necessary in the 4th axiom.

*Proportion of the 5th.*

The proportion of the 5th is the proportion of the sharp 3d and flat 3d; for by compounding  $\frac{5}{4} \times \frac{6}{5} = \frac{3}{2}$  or  $\frac{3}{2}$  the sesquialteral and known proportion of the 5th.

*Proportion of the Sharp 6th.*

The proportion of the sharp 6th is the compound proportions of the fourth and sharp 3d; for  $\frac{4}{3} \times \frac{5}{4} = \frac{5}{3}$ . Of the flat 6th, the proportion is of the 4th and flat 3d; for  $\frac{4}{3} \times \frac{6}{5} = \frac{24}{15} = \frac{8}{5}$ .

By the same manner of compounding are found the proportions of the concords of the 3ds; which shall be shewn when we shall have got the tones and semitones; which, as being discords, arise by dividing the harmonic proportions as follows.

PROPORTIONS of the DISCORDS proved.

*Proportion of the Greater Tone.*

The proportion of the greater tone is the difference of the 4th and 5th; for  $\frac{4}{3} \times \frac{5}{4} = \frac{5}{3}$  the proportion of the greater tone.

*Proportion of the Lesser Tone.*

The proportion of the lesser tone is the difference of the 5th and sharp 6th; for  $\frac{5}{4} \times \frac{6}{5} = \frac{3}{2}$  the proportion of the lesser tone.

*Proportion of the Semitone.*

The proportion of the semitone is the difference of the sharp 3d and 4th; for  $\frac{4}{3} \times \frac{5}{4} = \frac{5}{3}$  the proportion of the semitone.

Having now the proportions of the tones and semitones, we are enabled to prove the proportion of the semitone, or flat 2d and sharp 7th to the 8th; as likewise all the remaining proportions, whether discord or concord: For, the 5th and sharp 3d,  $\frac{5}{4} \times \frac{8}{7}$ , give  $\frac{10}{7}$  the greater 7th; and the sharp 9th and semitone  $\frac{10}{9} \times \frac{6}{5} = \frac{24}{15} = \frac{8}{5}$  in its lowest terms  $\frac{2}{5}$  the proportion of the octave.

To go on; The proportion of the sharp 3d is that of the greater



femitone, and one tone to the 5th; and thence by two tones and a femitone to the 8th. This is the order in a sharp key; where note, that the femitones are in the 4th and 8th places. No. 8.

In a flat key, the notes ascend according to the following example. No. 9.

One tone, a femitone, and two tones to the 5th; a femitone and two tones to the 8th.

In the next example, the same proportion of the flat third is illustrated by comparison with the instance in the sharp key, No. 10.

The number of the tones and femitones in both flat and sharp key are equal. The difference arises from the places of the femitone; which, in the flat key, are the 3d and 6th. This is that essential difference of tune already mentioned, which creates such variety in musical strains, as well as in the harmony. These are some effects of the femitone; others we shall see in its proper place.

#### *The Chromatic Scale.*

The chromatic rises by a tone and 5 femitones to the 5th, and thence by 5 femitones more to the 8th. Thus No. 11.

The chromatic scale, which is no other than the natural femitones in their order, except the first tone, is only used when mixed with the diatonic. That is to say, when a femitone, not belonging to the harmony of the key, is introduced in the middle of a tune. And this may be done by the note ascending by a femitone, or descending: in either of which cases, the key is changed in that part of the strain. This is the cause of great variety in the air; as well as it new-modulates the harmony. This is another effect of the femitone, on which turns so much variety and elegance. It must be executed by the composer with all the address and art imaginable. For this we must refer to the second part or practice; where will be given the rules for the mixture of the chromatic. Pieces of musick where it is frequently used, are now commonly called chromatic musick.

The diatonic scale being that which we are chiefly concerned to understand, as well as the first in order, and before any use of the chromatic can take place; we shall proceed to view it in another light, whereby we shall discover such properties of it as will be useful to the composer. Sharp key. No. 12.

From the key the thirds ascend, as in the above example, by one sharp 3d, two flat 3ds, two sharp 3ds, a flat 3d, and lastly another flat 3d on the 2d to the key.

All the 4ths being perfect, are like; except that one which falls on the sharp 7th; this is called a sharp 4th, or false 5th. No. 13.

All the 5ths are perfect, and therefore like; except that formed by the sharp 7th and 4th, which likewise is a flat 5th or sharp 4th. No. 14.

The 6ths stand thus: two sharp 6ths, one flat 6th; two sharp 6ths, two flat 6ths. No. 15.

There are but two greater 7ths which are the sharp 3d and sharp 7th to the key: they stand under the two femitones.

All the 8ths are perfect and alike.

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From these theorems, and axioms, the 2d and 4th, we deduce this practical corollary.

COR. IV. The 3ds and 6ths are the intervals most frequently to be used in composition; the 8ths, 5ths, and 4ths most rarely.

The 4th being an improper concord, and the 7th a discord; we cannot ascertain their use till we come to the demonstration of the harmony and accompaniments of the discords in the 2d part.

On this 4th corollary is grounded the reason of forbidding two 8ths and two 5ths in consecution, either in composition, or performing thorough bass.

Next follow examples of the same in a flat key., No. 16, 17, 18, 19.

There are but two sharp 7ths which are the 2d and 5th to the octave. They stand under the femitones.

All the octaves are perfect and alike.

It is evident to fight, that the intervals in the flat and sharp key do not in the least vary; except in the order they succeed each other, beginning from the key. And it is equally evident, that this variation is owing to the different places of the femitone.

This demonstrates what has been said in page 319. col. 1. concerning the femitone; and illustrates what is asserted in the 4th axiom, that variety, amidst uniformity, must be the great object attended to in musick, since that uniformity and variety both subsist in the very principles.

Let it be observed, that this uniformity is preserved by bringing in the flat 6th and flat 7th to the key. And this must of necessity be so, since they are the places of the femitone and lesser tone in the natural flat key wherein the example is set, according to the demonstration of the same.

For, by corollary 1. nothing can be admitted in composition which doth not immediately depend on the 2d axiom, and which cannot be demonstrated from it; namely, that the proportions of sounds, and their relations, must be deduced from the natural order of the notes. This is the true reason for introducing the flat 6th and flat 7th in every flat key.

The harmonic proportions and discords having been demonstrated from the division of a line in arithmetical progression; we shall, in the next place, try what are the effects of a musical string divided in geometrical proportion. No. 20.

Let AB, a musical string, be divided equally in C; CB, the half next the bridge, will sound an octave to the whole or open string, as we have shewn in the harmonic proportions.

Again, let CB be equally divided in D; DB will sound the octave to CB, or double octave to the open string, AB.

And thus, by an equal division of a string between either the nut and bridge, or stop and bridge; the half next the bridge will give the octave above continually.

But the same proportion is not preserved in the equal division between the nut and stop, or between any two stops. For the length of the octave to the open string, which is between the nut and stop, being equally divided; the half next the nut gives the sound of the 4th to the open string; and the half next the stop, or bridge,

4 M

1 sounds

ounds the 5th, which two are the constituent intervals of the octave.

And the same division of the sounds is constantly preserved, if the length of an octave be equally divided between any two stops.

Again, the length of a 5th between two stops, or nut and stop, equally divided; the half next the bridge gives the greater 3d, the other half the lesser 3d.

And again, the length of the greater 3d, thus divided, gives the greater and lesser tone. And the greater tone's length, equally divided, gives the greater and lesser semitone. And the length of the greater semitone, equally divided, gives the sounds in proportion as 5 and 4. The greater interval being next the bridge, and so continually.

Hence the necessity of the greater and lesser tones and semitones in music is evident; and the truth confirmed, which is asserted in the 2d corollary.

Now, in the diatonic scale, wherefoever the semitones lie, that is, whether the air be in a flat or sharp key, the graver part of the tone will be the lesser semitone, and the acuter the great semitone; and in the chromatic, which ascends by semitones, the greater and lesser semitones will, for the same reason, succeed each other alternately. Wherefore, if any series of chromatic notes be removed a semitone higher or lower; it must happen, that the lesser semitone will succeed into the place of the greater, and the greater into the place of the lesser. Hence dissonances will happen in the diatonic scale, as being composed of the same materials with the chromatic, if the key be injudiciously changed by transposition. For, as the dissonance will be evident, if the transposition be by one semitone; so the disproportion will still appear, if the removal be by any odd number of semitones within the compass of the 4th.

As the proportions of the concords have been demonstrated from the division of a line; so are they likewise to be found in the geometrical proportions of solid bodies, and therefore may be illustrated by the same.

We shall begin with the proportion of the 8th.

The proportion of the 8th being the compound proportions of the 5th and 4th, is, by corollary of the 34th proposition of Archimedes, as the whole superficies of a right cylinder described about a sphere, to the whole superficies of an equilateral cylinder inscribed as 2 to 1. For, the circumscribed is to the spheric superficies as 12 is to 8 (by 32 of this,) but the spheric is to the inscribed as 8 is to 6 by this present proposition: therefore the circumscribed is to the inscribed as 12 is to 6, or 2 to 1.

In harmonic terms thus expressed: the 5th is to a given note of key as 12 is to 8; but the proportion of the 4th is as 8 to 6. Therefore, the proportion of the 8th is  $\frac{12}{8} \times \frac{8}{6}$  as 2 to 1.

Again, the proportion of the 5th, and the next harmonical proportion arising out of the 5th, is beautifully illustrated in the admirable proportion of the sphere, right cylinder, and equilateral cone circumscribed about each other. The last proportion being invented by Andrew Facquet; and that of the two first by Archimedes, as demonstrated in his 45th proposition in Tacquet's Euclid.

We cannot forbear transcribing at length this wonderful proposition, and demonstration of the same: for that on this proportion is erected the whole superstructure of harmonic chords.

#### ARCHIMEDES'S PROPOSITION 45.

**THEOREM.** An equilateral cone circumscribed about a sphere, and a right cylinder in like manner circumscribed about the same sphere, and the same sphere itself continue the same proportion, to wit, the sesquialteral, as well in respect of the solidity, as of the whole superficies. For, by 32d of this book, the right cylinder ( ) encompassing the sphere, is to the sphere, as well in respect of solidity, as of the whole superficies, as 3 is to 2, or as 6 to 4. But by the foregoing, the equilateral cone circumscribed about the sphere, is to the sphere, in both the said respects, as 9 to 4. Therefore, the same cone is to the cylinder, both in respect of solidity and surface, as 9 is to 6. Wherefore, these three bodies, a cone, cylinder, and sphere, are, betwixt themselves, as the numbers 9, 6 and 4, and consequently continue the sesquialteral proportion, Q, E, D.

In harmonic terms expressed thus: the 5th is to the key as 3 is to 2, or as 6 to 4: but the 6th is to the key, (that is, the 5th to the 5th) as 9 is to 4; (for the 2d and its 8th  $\frac{9}{2} \times \frac{2}{3} = 3$ ;) therefore, the same 6th is to the 5th as 9 is to 6. Wherefore these three tones, the 6th, the 5th, and the key, are, betwixt themselves, as the numbers 9, 6, and 4; and consequently continue the sesquialteral proportion, Q, E, D.

Therefore, the proportions of the key, the 5th and its 5th, being the same sesquialteral proportion continued, are the same proportions as that of the equilateral cone, right cylinder and sphere; the two first described about the sphere, Q, E, D.

On the proportion of these three is erected every other proportion of harmony; which we shall pursue one step further, forasmuch as these truths will be most manifest and established in the practice when we shall have delivered the rules of harmony.

The 5th divided arithmetically, or equally, gives, as hath been shewn, the greater 3d or next perfect concord: the sesquialteral proportion to which gives the greater 7th; for  $\frac{9}{4} \times \frac{4}{3}$  gives  $\frac{9}{3}$  the greater 7th, as demonstrated above.

Hence, from the sesquialteral proportion thrice repeated, namely, to the key, its 5th and 3d, we are furnished with the perfect harmony, or concords of the key and 5th; to which every harmonic proportion, where ever found, is analogous; that is, partaking of the nature, proportion, and relation of the key and its 5th. It is worth remarking in this place, that the members of these chords arise out of the proportions, as above demonstrated, by turns. The key being first supplied with one proportion; and then in its turn the 5th with the same. Wherefore, the mixture of the harmony of the key and 5th is scarcely separable: A truth which will abundantly discover itself in the practice, both in the rules of harmony, and in every other part of composition. On this is founded the following axiom.

AXIOM.

ARTICLE VI. These 5 tones therefore, namely, the key, the 3d, 5th, sharp 7th and 9th, are the foundation of the whole superstructure of musick.

We shall conclude this theory with the harmonical division of a line.

To divide a Line harmonically. No. 21.

A right line, A D is said to be divided harmonically, if, being cut into three parts, A B, B C, C D, the case be so, that, as the whole A D (or Z) is to either extreme a or c :: so shall the other extreme be to the indeterminate part m; that is,

$$\left. \begin{array}{l} Z : a :: c : m \\ Z : c :: a : m \end{array} \right\} \text{ Wherefore } Z \overline{m} = a c.$$

And, to divide any given right line thus harmonically, as suppose A D: From either end of it draw a right line, as D G; make an angle with it, and of any length; con-

nect the end of this line with the other end A, by drawing A G; and then taking any point, as B, at pleasure, in the given line, there draw E F parallel to D G, and in it take B E equal to B F; then draw E G, and that shall find the point C required: and then calling, as above, the whole line Z, A B  $\overline{m}$ , B C  $\overline{m}$ , and D C  $\overline{c}$ , I say Z : a :: c : m.

For the triangles A D G, A B F, and B E C, are all similar: and consequently A D : A B :: D G : B F :: or as D G : to B F  $\overline{B E}$ . But as D G : B E : C D : B C; (by working about the equal angles D and E, B C) wherefore, by equality, A D : A B :: C D : C B that is, Z : a :: c : m. Q. E. D.

And from hence it is plain, that the ratio of the whole line A D, to the segment A B, may be taken at pleasure; but that the intermediate part B C must be less than either A B or C D.

## PART II. THE PRACTICE OF MUSICK.

THE practice of musick is founded on the principles delivered in the theory. Its several parts are, composition, figuring the bass, melody, transposition, and singing by note.

Of these we shall treat separately in the above order.

Composition is the setting together two or more notes in harmony, to be sounded at the same time.

When in the succession of concords, in the parts, the notes of each part are of the same length, or time of sounding the composition is called counterpoint.

When the succession of concords is by notes of different lengths in the several parts, it is called plain descant.

The mixture of discord and concord, by notes of the same or different lengths or time in the parts, is called figurate descant. Of these in their order: and first of counterpoint

In order to attain more easily the art of composition, it is necessary to premise a few things concerning other affections of sounds; as the time or lengths of sounding the notes; the time of musick, or movement of the air; and the different cliffs wherein the parts of musick are usually written.

The following account of the proportions of the lengths of notes, the time and cliffs, being well understood by every one acquainted ever so little with musick, might well have been omitted in an essay of this kind; (where, instead of using repetitions, it is hoped we have offered to the public something new; at least in the manner of demonstrating the rules of composition, both in discord and harmony;) but that we would leave nothing in our power untold, which may contribute to form a compleat musician.

The longest note, now generally in use in instrumental musick, is called a semibreve. Its time is as long as you can distinctly count for.

Out of the division and subdivision of the semibreve are formed the lengths of all other notes; according to the following proportions. No. 22.

A semibreve, whose time is as one, two, three, four, is as long

- as } 2 Minims,
- } 4 Crotchets
- } 8 Quavers,
- } 16 Semiquavers.
- } 32 Demisemiquavers.

A dot after any note, signifies the time of such note must be lengthened to one-half of the plain note. No. 23.

The proportions are thus;

A dotted semibreve is equal to 3 minims.

A dotted minim to 3 crotchets.

A dotted crotchet to 3 quavers.

And so of the rest.

Thus we are furnished with notes according to the odd and even numbers. And this naturally divides the time of any song or musick into odd and even time.

### COMMON TIME.

When the air moves according to the even numbers; and every bar is measured by beating the time into two equal and even parts, the musick is composed in common time: known by one of the following marks prefixed to the tune; as the letter C, having 4 crotchets in a bar; or  $\frac{2}{2}$ , denoting two crotchets in a bar.

### TRIPLE TIME.

But when the musick moves according to the odd numbers, and every bar is measured by beating the time into two unequal parts, as two and one, the song is composed in triple time; which is known by one of these signs prefixed to the tune.

3, or  $\frac{3}{4}$ , for 3 minims in a bar.

$\frac{3}{4}$  3 Crotchets in a bar.

$\frac{3}{8}$  3 Quavers in a bar.

$\frac{3}{16}$  9 Crotchets in a bar.

$\frac{3}{32}$  9 Quavers in a bar.

The uppermost number being the numerator of a vulgar fraction; and the lower, or denominator, the aliquot part of the semibreve.

There is also another proportion of the length of notes in use. And this is, when three quavers are, by division

nution of their lengths, contracted into the time of 2 quavers, or one crotchet, constantly noted by the figure (3) over them.

And lastly, the most common movement of jiggs, which is by six or twelve quavers in a bar, have their bass, for the smoothness of the movement, often written in plain crotchets; 2 in a bar for the treble  $\frac{6}{8}$ ; and four, marked thus C, for the treble  $\frac{4}{4}$ . It is plain, therefore, that all tunes in these movements truly belong to common time, since every bar is measured by the beating, or dividing it into even parts, as expressed in the bass.

A pause or rest in musick, is a cessation of the sound, in one or more of the parts; or of all the parts together. Nothing hath a finer effect in musick than a pause of all the parts judiciously made; or of one, or more of the parts, for the sake of imitation. The rests therefore are written down in the place of notes, and each note hath its own rest, which is of the same length with the note whose name it bears. Thus,

A semibreve rest is as long as a semibreve.

A minum rest as long as a minum.

And so of the rest.

The next thing to be considered is the cliff in which any part of the musick is said to be written; and according as the cliff is prefixed to each staff of the writing.

The use of the cliff is to ascertain the names of the notes; and to denominate that part of the musick to which it is prefixed.

There are three cliffs, to answer and distinguish the three parts in musick: The bass, or F cliff; the tenor, or C cliff; and the treble, or G cliff. No. 24.

The bass is so called, from its being the lowest part, or that wherein are set the graver tones.

The tenor, or middle part, hath its name from holding the bass and upper parts together. This will be clearly understood, when we shall have learned to compose in four parts.

The uppermost part is called the counter-tenor in vocal musick; and, in instrumental, the first treble.

The bass and treble cliffs are now constantly written in the same places as in the examples. The tenor cliff is often removed, according to the fancy of the composer or writer of musick; to answer the convenience of the notes standing, as much as may be, within the compass of the five lines, or staff. Which convenience is the reason for the invention of the diversity of cliffs, as well as the uses already named. For it is easy to apprehend, that the natural tones, and their proportions, are invariably the same, whether expressed by the voice, or an instrument, however they may be distinguished by artificial signs. Observe, that the cliffs, according to their names, rise above each other by the interval of a 5th: thus the tenor is equally distant from each other part. For C is a 5th to F, as it is also a 5th below G.

#### CHAP. I. OF COMPOSITION IN COUNTER-POINT.

COMPOSITION in counterpoint is when, in the succession of concords in the parts, the notes of each part are of the same length, or time of sounding.

According to the 2d axiom, we shall begin with the

harmony of the key note; and proceed to demonstrate the harmony of the remaining notes of the octave in their natural order.

#### *Demonstration of the harmony of the key.*

The harmony of the key is the concord of itself.

The harmony of the key must be perfect harmony. Now, the notes concurring in perfect harmony, are, by corollary 3d, the 3d, 5th, and 8th: But these, with the key, are the concord of itself: Therefore, the harmony of the key is the concord of itself.

This demonstration is grounded on this evident truth; namely, that any other concord would, by the term, or name of it, in effect change the key; whereby the unity of the tune would be destroyed, and by this contradiction the author's meaning rendered unintelligible. The necessity of perfect harmony in the key being evident, no other sort of demonstration is required, nor indeed can be admitted.

PROB. Let it be required to set a bass to the notes of an octave ascending in G sharp. No 25.

Any one of the three notes in the bass is concurring, by corollary 3; but the 8th is preferable when it is the first or last note of the tune; for thus it best ascertains the key. The preference of either of the other two depends on the following rules.

First, The 5th cannot take place when the concord immediately preceding shall happen to be a 5th, the forbidding the consecution of 5ths being asserted in corollary the 4th.

Again, the movement of the bass ought generally to be by descending a 5th, or rising a 4th, 6th, or 8th, or any other great interval; thereby meeting the treble, and effecting variety and contrary motion of the parts; the established rules of harmony by the 4th axiom.

Lastly, The air of the bass must be consulted; and, if possible, an imitation of some foregoing passage in the upper part.

The application of these rules will decide which of the two or three notes is preferable in this or any other concord.

#### *Demonstration of the harmony of the 2d.*

The harmony of the 2d is the concord of the 5th.

The harmony of the key having been shewn, we must consider it as an immoveable point, in relation to which we are to order the rest of our computations, consistent with the established principle of uniformity.

The 2d to the key immediately descending into the key, will have, for its next concurring note, the greater 7th; which at the same time ascends by a semitone into the key; to which 7th the 2d is a 3d.

For, by axiom 2, the combination of sounds are deduced from the natural order of notes ascending and descending. But the 2d and 7th can admit no other concordant note but the 5th to the key. For the 3d is discord with the 2d; and the 4th, 6th, and 8th discord with the sharp 7th.

Now, the 2d, 7th, and 5th are the concord of the 5th; therefore, the harmony of the 2d is the concord of the 5th. No. 26.

The

The 5th must always be taken at the close ; or when the treble is descending into the key ; for then the bass will fall a 5th into the key ; which movement is called the great cadence. Otherwise the 7th or 5th may be taken indiscriminately ; yet, under the restriction of the rules, (p. 326. col. 2.) for setting the harmony of the key.

*Demonstration of the harmony of the 3d.*

The harmony of the 3d is the concord of the key.

From the demonstration of the harmony of the key, the key will have its 3d ; and, by inverting, the 3d will have the key. Now, the key and its 3d will admit no other concordant note : but its 5th : For the 2d is discord to both, the 4th is discord to the 3d, and the 7th discord to the key ; but the key, its 3d and 5th, are the concord of the key. Therefore, the harmony of the 3d is the concord of the key.

The 6th indeed, which is a 4th to the 3d, which is an improper concord, will, with the key, form the concord of the 6th ; but the demonstration of the concord of the 6th in a sharp key, depending on another principle, as will be shewn in its place, can, for the same reason, bear no relation to the harmony of the 3d, which is a member of the key : No. 27.

The two notes in the bass may be taken indiscriminately ; yet complying with the rules. (p. 326. col. 2.) But, if the 3d in the treble be prepared to descend into the key, by its passage into the 2d, then the 5th is more eligible ; which falling an 8th for the next note, thence descends by a 5th into the key. This is the most striking movement of the bass ; and, at the same time, the most common, at a final close in either flat or sharp key.

*Demonstration of the harmony of the 4th.*

The harmony of the 4th is the concord of itself.

In a sharp key, the places of the two greater 7ths are the sharp 3d and sharp 7th to the key : and, of the semitones, the 4th and 8th, or key ; Therefore, the 3d is to the 4th as the sharp 7th to the key. Now, since by axiom 2d, the combinations are deduced from the natural order of the notes ascending and descending ; the harmony of the 4th will be as the harmony of the key : But the harmony of the key is (by demonstration 1.) the concord of itself : therefore, the harmony of the 4th is the concord of itself. No. 28.

The notes in the bass may be taken indiscriminately : only observing the foregoing rules. If a close on the 4th be prepared from the 4th itself, either note will do : yet the key is preferable, in order to prepare for the great cadence.

*Demonstration of the harmony of the 5th.*

The harmony of the 5th is the concord of the key.

From the demonstration of the harmony of the key, the key will have its 5th ; and, by inverting, the 5th will have the key. Now, the key and its 5th will admit no other concordant note than the 3d. For, the 2d and 4th are discord with the key and 5th ; the 6th discord with the 5th ; and the 7th discord with the key. But the key, its 5th and 3d, are the concord of the key :

therefore, the harmony of the 5th is the concord of the key. No. 29.

There is no exception in the choice of the bass notes ; but the disallowance of the consecution of 5ths. But if there be a preparation for a close on the key, and the 5th stand in the bass ; in order to make the great cadence, the 5th will have its own concord. This depends on the demonstration of the 2d.

*Demonstration of the harmony of the 6th.*

The harmony of the 6th is the concord of the 4th.

From the demonstration of the 4th, its harmony is its own concord. The 4th, then, will have its 3d ; and, by inverting its 3d (that is, the 6th) will have the 4th. Now, the 4th and 6th will admit no other concordant note than the 8th : For the 2d is, (with the 4th and 6th,) a discord, as will be shewn in the demonstration of the discords. The 3d and 5th are discord to the 4th, and the 7th to the 6th. But the 4th, 6th, and 8th, are the concord of the 4th : therefore, the harmony of the 6th is the concord of the 4th. No. 30.

Either note in the bass may be taken at will. But if there be a preparation for a close on the 4th, the second note, or key, is preferable, for the reasons assigned in the demonstration of the 4th, which is, to make the great cadence, prepared by the bass, first descending an 8th, and thence a 5th, into the 4th, or close.

*Demonstration of the harmony of the 7th.*

The harmony of the 7th is the concord of the 5th.

The harmony of the 7th is part of the harmony of the 2d, (by demonstration 2.) but the harmony of the 2d is the concord of the 5th : therefore the harmony of the 7th is the concord of the 5th. No. 31.

If the 7th, or treble note, precede a close on the key, the first note in the example must be the bass note, in order to make the great cadence.

The 8th being the key, hath for harmony its own concord ; as by demonstration 1.

From the foregoing demonstrations, the bass notes, set to the 8 ascending notes in the treble, will stand thus.

GENERAL RULE. The consecution of 8ths, 5ths, and 4ths, is not allowed, (as by corollary 4.) except by contrary motion of the parts, or in the passage of very quick notes in composition of many parts. No. 32.

From taking in one view the harmony of the seven notes, we shall deduce some useful corollaries. No. 33.

Key 2d,	3d,	4th,	5th,	6th,	7th,
hath the harmony of the					
Key 5th,	Key 4th,	Key and 5th,	4th,	5th,	Semitone.
Semitone.					

COR. I. Every note in the octave (except the 2d to the key) admits in its harmony a 3d.

COR. II. The key, the 2d and 5th, admit in their harmony a 4th.

SCHOLIA.

When the key admits a 4th, the concord is of the 4th.  
 When the 2d admits a 4th, the concord is of the 5th.  
 When the 5th admits a 4th, the concord is of the key.  
 Hence the interval of that note which admits a 4th, is in fact a 5th : therefore two 4ths are no more allowed

in consecution than two 5ths. And hence likewise the interval of the 4th, which we have called an improper concord, appears to be of a middle nature between concord and discord; being a fourth in name and appearance in the natural order of sounds; yet a 5th in name and effect in composition, as member of that chord wherein it makes a part of harmony.

COR. III. The key, the 4th and 5th, admit in their harmony a 5th.

SCHOLIA.

When the key admits a 5th, the concord is that of the key.

When the 4th admits a 5th, the chord is of the 4th.

When the 5th admits a 5th, the concord is of the 5th.

Hence, when a note admits a 5th, the harmony is the concord of the same note.

COR. IV. Every note but the 4th admits a 6th; for, the 4th having its concord for harmony, will have only its 5th.

Every note admits its 8th; for any note may be substituted for its octave. But 8ths are (by corollary 4. of the theory) to be the most sparingly used, as not producing that variety or mixture of sounds requisite to bind the harmony, especially, where it can be best avoided, in the composition of two parts.

From the foregoing demonstrations and corollaries, arise the following observations.

The 3ds and 6ths most frequently occur in composition. This then demonstrates what was asserted, by way of precept, in the 4th corollary of the theory as well as part of the 4th axiom; namely, that the proportions of musical sounds, and the variety emerging from them, point out to us this variety, and will not suffer us to depart from the established precept.

It will be necessary to see the same truths confirmed in the descending notes. We shall therefore set down instances of composition in the descending notes of the octave upon the same principles, and wherein the same demonstrations and corollaries do take place.

Example of composition in the descending notes of the octave. No. 34.

In the ascending notes, when the upper part rises by a semitone, the bass generally falls a 5th; when the upper part falls by a whole tone to a close, the bass also falls a 5th. This fall of the bass, or great cadence, must be effected when chromatic notes are introduced ascending; it being the property of the new semitone, thus formed by the note rising a half tone, to imitate the key or close. By axiom 2. the proportions of sounds, and properties of the same, are deduced from the natural order of the notes. Now, by the new semitone introduced, the note below imitates the greater 7th to the key: therefore, in this case, as in a close on the key, the bass must fall a 5th.

Notwithstanding, this must be understood not of the passage of quick notes; and chiefly at a close.

Sect. 2. *Of Composition in a FLAT KEY.*

FROM the difference between the flat and the sharp key which lies in the different places of the semitone, there will arise a variety in the composition in a flat key,

yet resting on the principles and demonstrations delivered in the last section.

The places of the semitone in the sharp key are the 4th and 8th. In a flat key, the semitone stands in the 3d and 6th places. The variety in the composition will happen where the semitones are concerned. For, as the middle close is made in the sharp key on the 4th, which is the semitone; or, as the 4th in the sharp key hath (by demonstration of the harmony of the 4th) its own concord for harmony: so the middle close in the flat key is made on the 3d, which is the semitone; or the flat 3d will have for harmony its own concord. Now, as the 4th hath its 3d and 5th for harmony, (which are the 6th and 8th of the key); so the flat 3d will have its 3d and 5th, which are the 5th and 7th of the key.

Again, the flat 7th of the key being the 5th to the 3d, will, like the 5th of the sharp key, have for harmony its own concord. This will cause the 2d of the key to appear as the sharp 7th to the 3d, and the 4th of the key as a 2d (which it really is) to the 3d. Thus the whole harmony will be new modulated by the power of the semitone. Again, the flat 6th being the semitone, a middle close may be made on that note; and then the same proportional variety succeeds, and new harmony, as in the former case.

Lastly, at the end of the musick, where there must of necessity be a close, the flat key will have the greater 7th, like the sharp one. Of so great consequence is the semitone. Nor indeed can a close be made at all, without the passage of a semitone in one or other of the parts. No. 35.

*Differences in the flat key noted.*

In the first example the harmony of the 2d is the concord of the flat 7th, as being 5th to the third.

The close is made on the 3d, the bass falling a 5th.

The 4th hath its own concord, as in the sharp key.

The 5th standing in an octave, may be understood as part of the harmony of the 3d, as the 3d to the key, in a sharp key.

The 6th is part of the 4th's concord, as in the sharp key; as above in the remark on the 4th.

At the close, there is the sharp 7th, from which the bass makes the great cadence.

In this example there happen four 8ths: the first and last are absolutely necessary to ascertain the key; by the second there is a close made on the 3d; and that on the 5th, is for the sake of the air in the bass.

In the second example, the harmony of the 4th is the concord of the flat 7th, as 5th to the 3d.

The harmony of the flat 6th is its own concord, being the place of the semitone; where the bass rises a 4th (the same as falling a 5th) as on a close in the treble ascending by the semitone.

In the 3d example, these differences of the flat key are left out; and the notes set as if they were part of a sharp key: that is to say, there is no close made on the 3d: the 4th hath its chord for harmony; and the 6th is likewise part of the harmony of the 4th.

For, notwithstanding the propriety of making a close on the 3d and 6th, which are semitones; yet the composer

is not under the necessity of making a close in these places in every passage; and then he is at liberty of setting the notes as in the example. This observation clearly points out the difference of composition in a flat key, and where it is to be practised.

And indeed an author, whose sole end is to please the ear, will designedly introduce a close on the flat 3d, and in as many other passages as he can, to create the variety so much desired. In these cases, the rules delivered for composition in the flat key must undoubtedly take place.

The fourth example is set to shew the movement of the bass to the descending notes. The composition is the same as in the other examples.

Let us now take, in one view, the full harmony of every note in the flat key, and where the difference between it and the sharp key lies: from which we may derive some useful corollaries. No. 36.

	The harmony of the			
2d,	3d,	3d,	4th,	
	is the concord of the			
Flat 7th,	3d,	Flat 6th,	Flat 7th.	

COR. I. The 2d admits a 3d; then the concord is of the flat 7th.

COR. II. The 3d admits a 5th; the concord is of the 3d.

COR. III. Again, the 3d admits a 4th; then the concord is of the flat 6th.

COR. IV. The 4th admits a 4th and 6th; the concord is the flat 7th.

By comparing these with the corollaries on the sharp key, it will be evident, that each note in the flat key admits for its harmony that note which was excluded in the sharp key. And therefore, that all harmony is divided between the flat and sharp keys; and wonderfully diversified by changing the places of the semitone.

From the demonstration of the harmony of the 5th, with corollary 3. on the sharp key, and the scholium 3. on the same, we gather how great a share of the harmony belongs to the 5th. For it is part of the harmony of the key, and of the 2d (which chord is its own, or that of the 5th) in both flat and sharp key: and, in the flat key, it is likewise in the harmony of the 3d.

The nature and properties of the semitone being the same in both keys, we can now more clearly demonstrate the harmony of it in the following manner.

The harmony of every semitone is the concord of the same.

The key always stands between the greater 7th below, and the whole tone, or 2d, above. Now, by axiom 2. of the theory, the proportions, properties and relations of sounds are deduced from the natural order of the notes ascending and descending: The 4th (in a sharp key,) the flat 3d, and flat 6th, being semitones, are distant by a half tone below, and a whole tone above, as is the key; therefore they have the same properties with the key. But the harmony of the key is the chord of the same: therefore the harmony of the semitone, or 4th, flat 3d, and flat 6th, is the chord of the same. Hence we raise the following axiom.

AXIOM I. The harmony of every member of the concord of the key, is the concord of the key. And the

harmony of every note in the compass of musick, proved by the rules of harmony, is part either of the concord of the key, or of its 5th, or of a semitone. Hence variety in musick is introduced by the contrary motion of the parts, and by changing the key, by bringing in new semitones. The better to illustrate this axiom, we shall hereafter in the examples set harmonical figures over every note, expressive of the chord.

FIRST EXAMPLE.

Let it be required to set a bass to this treble in G sharp. No. 37.

Harmony of the

SECOND EXAMPLE. No. 38.

Harmony of the

THIRD EXAMPLE.

In A flat, No. 39.

FOURTH EXAMPLE.

In G flat, No. 40.

FIFTH EXAMPLE.

In A flat, No. 41.

SIXTH EXAMPLE.

In D sharp, No. 42.

In these examples every passage occurs which hath been delivered in the precepts of composition.

Take notice, that in the last example, the four passages, where the harmonic figures are not set over the notes, are part of a discord; which would take place, if the composition were in three parts; and which we cannot explain till we come to figureate descant.

SECT. 3. Of Composition in THREE PARTS.

THE harmony, or full concord, of every note being well understood, both by reading the foregoing examples, as well as making application of the rules of composition on which the examples are framed, by trial of setting basses to other airs; the next step will be to proceed to composition of three parts.

This requireth no other precept than those already delivered, touching the harmony of each note. For the third part consists of the remaining notes of each concord which have not been made use of in the composition of two parts. Yet this caution must be used, that the two upper parts stand in the nearest concord to each other: that is to say, in 3ds as much as may be, and is consistent with variety and contrary motion of them. For hereby two points will be gained: first, it will bind the harmony; and secondly, the bass, being more at liberty to rise and fall by greater intervals, will meet the upper parts at every point, and produce variety by his contrary motion. The following examples are the same set in two parts above.

PROB. Let it be required to set a bass and second part to this treble. No. 43.

PROB. Let it be required to set the ascending notes of the octave in three parts, in a flat key.

In G flat, No. 44.

In A flat, No. 45.

In G flat, No. 46.

The harmony of the seventh bar in the last example, is altered in the repetition; though the notes of the first treble be the same.

In the first instance, the concords are of the key and 5th. In the repetition, the concords are of the 3d and flat 7th.

In the first instance, the passage from the 5th into the key, (in the 8th bar,) being the great cadence, is just.

But if otherwise a close had been made on the 3d, (in the 8th bar,) the harmony in the second instance must, for the same reason, be preferred.

Hence it will be easy to decide in all flat keys, (to which only this case belongs) when the harmony of the 3d is to be part of the concord of the key, and that of the 2d the concord of the 5th; or, when the harmony of the 3d is to be its own concord, and that of the 2d or 4th part of the concord of the flat 7th.

Hence, and from corollary 1. of the theory, and from the demonstration of the harmony of the semitone, we deduce this general theorem.

The truest harmony is produced by the whole concords taken together falling in succession, as frequent as is consistent with the approved rules of harmony, by a 5th.

We shall put an end to composition in three parts, with the following example in a flat key, being one of these above in two parts. No. 47.

The use we shall make of this example is to remark, that although the bass be altered from that which is set in the same example in two parts: yet the harmony is the same, as is evident from the harmonic figures set over each.

Secondly, The 4th having its own concord, passes into the key, or 3d, in the passage of quick notes, and where there is not a close. But where, on the 6th bar, a close is made on the 3d, the bass making the great cadence, the 4th in the preceding bar is part of the concord of the flat 7th. And thus the whole harmony falls a 5th.

We have altered the bass also to answer the purpose of the movement of the upper parts in the closest harmony. And likewise to prove, that composition of many parts differs from that of two only. A truth which every composer should always have in view. For it will be found, upon trial, that, when the musick is set in two parts, if it be required to add a third, it will not be in the power of the composer to give that third part an air. A matter which ought to be studied by all means; and which, it is evident from the example, can be executed, without injuring the harmony in the least, by composing the three parts together.

We therefore recommend it to the practitioner to make himself perfect in the composition of two parts, before he engages in three; as he will thereby not only sooner become master of the harmony; but also, by discovering more clearly the difference we are pointing out, will execute the composition of three parts with more ease and propriety.

#### SECT. 4. Composition of FOUR PARTS.

In composition of 4 parts, every note in the concord is taken; or to every note there is full harmony.

The fourth part, or tenor, now to be added, consists of the remaining note of the concord, which was not used in composition of three. The octave therefore will take place in the concord of every note. The consecution of which, as well as of 5ths and 4ths, is to be avoided between the same parts. The rules already delivered in the composition of three parts must be attended to in this.

Example of the ascending notes of the octave in composition of 4 parts. No. 48.

#### SECOND EXAMPLE.

In the descending notes of the octave in composition of 4 parts. No. 49.

#### THIRD EXAMPLE in 4 Parts.

In A flat, No. 50.

#### FOURTH EXAMPLE in 4 Parts.

In G flat, No. 51.

In composition of 4 parts, it was said, that to every note there is full harmony. Notwithstanding, in the first example, the sixth notes of the first treble and tenor are in unison; each being a 6th to the bass; so that the octave hath no part in that concord. This is done to avoid the consecution of 8ths, by the succeeding note of the tenor, whose place must be, for the air's sake, the 8th to the bass, as well as to bind the harmony.

In the second example, the seventh notes in the first and second trebles are in unison; both being a 5th to the bass. Let not this be understood to be a consecution of 5ths, as they are members of the same chord; but is done for the sake of the air of the second treble. Let this remark serve for every like instance which may happen hereafter.

In the fifth bar of the third example, the second note, the second treble and tenor are in unison. This is done to avoid the consecution of 4ths, which, had the tenor kept his place, would have happened from the foregoing note between the first treble and tenor.

In the same example, there is a consecution of 5ths in the two next bars, by the tenor falling a 4th, and the bass rising a 5th. This seeming error is tolerated, since it is effected by contrary motion of these parts. For as well as it is by the contrary motion of the parts, that the consecution of perfect concords is avoided; so for the same reason, the sameness of the harmony disappears, or escapes the ear; especially in composition of many parts.

By this reason, the consecution of 4ths is prevented by the bass rising a 3d, according to the first observation on this example, at the 5th bar. For that would have happened by all the parts descending; that is, not having contrary motion. The second note then of the bass in that bar is changed from that which is set in the same example in three parts.

A few general remarks occur in this place, from comparing the composition of four parts with that of three.

First, Whereas the perfect concords have place in some part of the harmony of every note in musick of 4 parts; so the chances of the consecution of 8ths and 5ths being more frequent, the more skill and attention will be required to avoid them.

Secondly,

Secondly, Composition of 4 parts differs in many particular passages from that of three, though the general precepts of harmony belong to both. For, by comparing the same example in both cases, there will be seen a variation of some passages in the lower parts. The necessity of complying with the established precept of variety, by preventing the succession of perfect concords, hath caused this alteration. See the 5th bar of the example in A flat in the three different compositions.

Hence arises a new reason for saying the composition of many parts differs from that of few, or two only. Therefore, in whatever number of parts the musick is to be composed, one design must be first laid down; and to adjust and perfect the harmony, and to create as much variety as possible, the whole work must be planned at once, and executed agreeable to that design.

Lastly, Of the tenor in particular, we have this to remark, That, whereas in composition of three parts, there is often a liberty left of taking any one of the concordant notes to the bass; in four parts, the fourth or tenor coming in leaves no room for that liberty; but obliges us to a certain disposition of each member of the harmony, and by this means holds together the parts, the octave every where founding and binding the inner notes together.

This remark on the tenor is more particularly true at almost every close, where the tenor note is the 8th to the bass on the last note but one of the close; and, by keeping its place, while the bass making the great cadence falls a 5th, the same tenor note becomes its 5th. Thus the two concords are held together and entire by the tenor's not removing.

#### SECT. 5. COMPOSITION of FIVE PARTS.

THE four concordant notes answering exactly to four parts in composition; when a fifth part is to be added, it is evident one note of the harmony must be repeated in every concord. The fifth part therefore consists of the notes which are by turns repeated in each of the former, in which the avoiding the consecution of the perfect concords is to be observed as before; and the air of this part attended to as far as may be consistent with the rules delivered.

Example of composition of 5 parts in the ascending notes of the octave. N. 52.

Second Example in 5 parts. No. 53.

The two octaves between the tenor and bass on the sixth and seventh notes of this example, are allowed; as the parts do not move into other notes, or make a new concord.

Third Example in 5 parts. No. 54.

The consecution of 5ths between the tenor and bass is admitted, as they meet by contrary motion of the parts.

Fourth Example in 5 parts. No. 55.

It is observable from these examples, that the most difficult composition is that of 4 parts. The other 4 parts, consisting of a repetition of one or more of the concordant notes of the first four parts, are more easily contrived, nothing more being required than to avoid the consecution of the perfect concords between any two parts.

#### SECT. 6. COMPOSITION of SIX PARTS.

IN musick of six parts there is a repetition of two concordant notes. The sixth part therefore consists of the notes which take place in each of the five former, by turns.

An example or two will sufficiently illustrate this.

Example of composition of 6 parts. No. 56.

There is a consecution of 8ths between the fourth line and bass, on the 3d and 4th notes; but it being the effect of contrary motion is admitted.

Second Example in 6 parts. No. 57.

The two 8ths between the tenor and bass are allowed; for, as they do not move, they are in effect but one.

Third Example in 6 parts. No. 58.

The consecution of 8ths is by repetition of the same note, and therefore reckoned as one.

Fourth Example in 6 parts. No. 59.

In the 8th bar there is a consecution of 8ths between the third part and tenor effected by contrary motion of these parts.

#### SECT. 7. COMPOSITION of SEVEN PARTS.

IN composition of seven parts, three notes of the harmony are repeated in each concord. The seventh part therefore consists of the notes which are taken by turns from each of the six former; or, which is the same thing, from the first four; under the restriction of the rules concerning the consecution of 8ths, 5ths and 4ths between any two of the parts, unless produced by contrary motion of the same, or repetition of the notes, or in the octave, as said above. The seventh part is written in the tenor cleff, and is a second tenor to the first; so that, like the upper parts, it must stand in the nearest concord to the first tenor, or next part.

First example of composition of 7 parts. No. 60.

Notwithstanding it hath been said, that three notes of the harmony are repeated in each concord in seven parts; yet it doth not appear in every instance in the example. The reasons are, that in every close, whether middle or final, it is preferable that most of the parts should end in the concord note of the close, and especially of the last close, that the harmony of the key may make the deeper impression on the sense.

Secondly, The air of each part should be consulted: for this will not only justify, but demand the changing of one note of the harmony for another.

Again, as the parts next each other should stand in the closest concord; so, in order to effect this sometime by contrary motion, they will meet in unison; and therefore the repetition of the three notes will not take place in every chord.

These rules will be sufficient to answer any doubt, or determine any choice to be made of any note of the concord, as well as justify the meeting of the parts in unison, in music of any number of parts whatever.

Second example in 7 parts. No. 61.

Third example in 7 parts. No. 62.

#### SECT. 8. COMPOSITION of EIGHT PARTS.

THE eighth and last part is the second bass; concerning

ing which the following rules and observations must be premised.

If the musick be composed for voices and instruments in full choir, it will be elegant and proper that the second bass stand in the nearest concord with the first, after the example of the trebles and tenors.

The reason is, that the two choirs singing either together, or in responses, will thus exhibit greater variety.

After this manner we shall set the two following examples.

If the musick be for instruments only, the difference of the basses consists in two things: First, The organ hath the figures of the thorough bass written. Secondly, The bass viol performs the solo parts, while the organ rests. And in full concert the two basses move in unison. This is the manner in which the basses of instrumental musick are set by the most approved masters.

We shall in this place offer our opinion on the subject of two basses in instrumental musick, relating to some alteration from the usual method of practice described above; which, as being perhaps new, will be received according to the notice it deserves.

We would have the part for the organ move in long notes, and by the least intervals; the figures filling up the harmony and discord; while the part for the violoncello moving in quicker notes, and greater intervals, becomes descant to the other bass. Of this an example shall be given when we come, in the next place, to treat of plain descant.

To return: In musick of 8 parts, the four notes of every chord are repeated, (allowing the exceptions remarked above.) Therefore, the full harmony of every note is double. The due mixture of which, according to the rules delivered, and the contrary motion of the parts, produce all the variety which harmony without discord is capable of affording.

First example of composition of 8 parts. No. 63.

Second example in 8 parts. No. 64.

Having given examples sufficient for instruction in composition of harmony in the several parts of musick, and having illustrated in the same examples what hath been said concerning the harmony proper both to flat and sharp keys; we shall proceed to make such observations on composition in general, as may assist the practitioner in the application of the rules at the beginning, or first attempts.

And first, concerning the consecution of perfects; which must be avoided, except in contrary motion of the parts, or repetition of the concord in the same notes in each part, or in the octave.

Let the intervals which constitute the octave be remembered, as hath been said above (in p. 321.) namely, a 5th and 4th, a 6th and 3d, a 7th and 2d; taking care, that when the note of one part rises or falls by one of these intervals, the note of the other part should not fall or rise by the interval which is the complement of the octave.

Thus the consecution of 8ths will be easily avoided, and much trouble thereby saved in setting the parts.

Again, by the same caution, we avoid the consecution of 5ths. For the notes set in the concord of a 5th, rising and falling together in the different parts, by the

same constituent intervals of the octave, will likewise meet in a 5th; and, by avoiding such movement of the notes of a 4th, the consecution of the same is in the same manner prevented.

One instance of each will shew this evidently. No. 65.

The consecution of perfects, it is true, is tolerated, when effected by contrary motion of the parts. But these observations are made for the sake of a beginner, that he may not too often incur the abuse of this liberty.

The next observation is concerning the harmony of the 4th in a flat key.

The 4th in a flat key is either part of the concord of the flat 7th, or hath for harmony its own chord.

The harmonical figures over the examples point out this to sight. Notwithstanding, it may be asked in what case either harmony is to be preferred.

We shall endeavour to ascertain this matter upon the principles on which what hath been already taught is demonstrated.

In page 430. col. 1. we deduced this general theorem; That the truest harmony is produced by the whole concords taken together, falling in succession, as frequent as is consistent with the approved rules of harmony, by a 5th.

Therefore, when a close is made on the semitone, or flat 3d, the harmony of the 4th or immediately preceding note, must be the concord of the flat 7th. For thus the whole chord, or harmony, according to the foregoing theorem, falls a 5th.

And this theorem extends to the harmony of every note whose interval is a semitone, or which stands a half tone above and a whole tone below its contiguous notes, whose movement into the next chord must be falling a 5th.

The places of the semitone in the harmony of the key, are the key, the flat 3d, the 4th (in a sharp key,) and the flat 6th, and not in the harmony of the key, wherefoever a semitone is introduced by the addition of a sharp or flat, whereby a close may be made on the semitone above.

Thus the truth of the first axiom of the practice is established; where it is said, That the harmony of every note in the compass of musick, proved by the rules of harmony, is part of the concord of the key, or its 5th, or a semitone. For the flat 7th is to the flat 3d a 5th.

In the other case, when a close is not made on the flat 3d, or when the harmony need not fall a 5th, then the 4th may have for harmony its own chord. And here the 4th stands generally in the bass. Thus No. 66.

The proof of this depends on the relative proportion of the flat and sharp keys; and will be given, by that analogy, under the article of transposition.

The last observation is in respect of the practice of authors of instrumental musick, in composition of many parts.

Whereas in the composition of 7 and 8 parts, the harmony of the notes are doubled: this is effected by the common practice, after the most easy manner, by doubling whole parts; that is to say, by two alternate parts moving through every note in unison, when in full concert; and likewise other two alternate parts. Thus the first and third violins play in unison; and the second

and

and fourth. And, when these parts are not thus doubled, the third and fourth parts rest. Or otherwise, in some passages they take part of the harmony from the other parts, as in the examples above of 7 and 8 parts; excepting only in longer notes than the upper parts. The concertos of Corelli, Geminiani, and the overtures of Handel, are instances of this.

In a word, whatever form the parts of musick may be disposed in, the principles of harmony are the same.

And when the rules of composition in counterpoint, which is the ground-work, are well understood, and confirmed by practice, the remaining part will become easy in proportion as the composer will find himself more at liberty to dispose of the parts to such advantage as he will judge most suitable to the genius of the musick he is about to compose.

## CHAP. II. OF PLAIN DESCANT.

THE second manner of composing is when the succession of concords is by notes of different lengths in the several parts. It differs from counterpoint, not in the principles of harmony, but only in the form.

The effect of descant is variety; which is produced, either when two or more notes of one part are set against one note in another, or when a long passage in one part is set against a single note in the other. This last manner is properly called descanting on that note. Or lastly, When a subject is set in the bass, and constantly repeated; while at every repetition of the same, there is a variation in the treble, which diversifies the harmony, but doth not deviate from the rules of art.

This bass, which is the first written part, is called a ground bass; and the piece of musick is called a ground.

Again, in descanting, it is usual for the parts to relieve each other; the bass sometimes holding the note, while the descant is in the treble; and again, the note is held in the treble, while the descant is in the bass.

The finest descant is where the discords are introduced in the passage of the notes. For here the air is less constrained; and the variety, in respect of the harmony, greater. This is figurate descant, which shall be treated of in the next chapter.

To return to plain descant: The movement of every part is more free than in counterpoint; and not so easy and unconstrained as in figurate descant. From this then arise its chief uses.

In the first place, it is the best introduction to the practitioner, to give an air to every part of his musick: It is also the ground-work of inventing variations in the treble upon a plain subject in the same part. The rules for plain descant are these.

Every note in the descant must be one of the harmony of each note in the bass; as demonstrated in composition in counterpoint.

Secondly, If the descant be variation on a given subject, in the treble, the original air must be preserved as much as possible in imitation of the same.

The harmony then being the same as in counterpoint, the difference being only in the form or length of the notes, one example, after so many given in counter-

point before, will be sufficient to illustrate this part. No. 67.

Whatever the subject of descant may be, whether a ground bass, or air in the treble, (the descant on which is called variations,) the practice is the same; as in the example, where the bass is the ground to the four trebles, the uppermost line of which may be called the air; and the other three descant on the bass; as well as variations on the subject, or first line.

For the more easy execution of both kinds, take these following rules of practice.

If you are to raise descant on a ground bass, then on this supposition the bass is first framed. Next let plain notes in the treble be set, as in the example, though no other use were to be made of them than to guide the composer's eye, and thereby furnish matter more readily for a better air and for the descant.

If the subject be an air in the treble, on which you are to make variations; as, in this case, the air is the first part written, so it is the object on the book to which you are to attend constantly as a pattern for the variations or descant.

It would be advisable also to set a plain bass to the treble or plain song, before you begin the variations. For, as the bass, or second note, in many cases determines the concord of the note; it thereby assists and rules the descant to be raised.

In general, when the two parts are set in plain harmony, the descant ought to imitate, and not depart from that design. If otherwise a discord be introduced in the composition of the two plain parts, or a discordant note be brought in in the treble or air, the descant must take part of the discord,

This properly belongs to figurate descant. Notwithstanding, it is an elegance common in practice, to throw in a discordant note in the variation, which is not in the plain song.

But these rules are addressed only to beginners.

Having done with plain descant, we shall here give an example of what hath been offered (p. 332. col. 1.) relating to the manner in which we would have the two basses set in composition of many parts; which is, That the part for the organ should move in long notes, and by the least intervals; the figures filling up the harmony and discord; while the part for the violoncello, moving by quicker notes, and greater intervals, becomes descant to the other bass.

The manner of setting the two basses depending on the principles of plain descant, and implying nothing more than what is contained in the last example, one instance of this will sufficiently answer our intention here.

Example of two basses in composition of many parts. No. 68.

The variety will be still greater if this manner be pursued in figurate descant. For as undoubtedly that is the best and most perfect composition where discord is intermixed; so there is no variety, which musick is capable of, produced from the form or disposition of the parts, that will not receive improvement from the more perfect composition.

The last example therefore, and what hath been said of the two basses in plain descant, is meant as an introduction to a trial of the same in the more perfect, or figurate descant, both in the composition and performance.

### CHAP. III. OF FIGURATE DESCANT.

FIGURATE descant is the mixture of discord and concord, by notes of the same or different lengths or time, in the several parts.

Every interval in musick which is not harmony, must be discord.

The discords therefore are six: namely, the lesser and greater 2d; the sharp 4th, or flat 5th; the lesser and greater 7th; and the 9th. The reason for repeating the 9th, which is the 8th to the 2d, shall be shewn in its place.

The use of discord is twofold: To give a better air to every part of the musick; and to create variety. For the discords standing in the natural order of the notes, between the concords, afford an easy passage of the same; and, at the same time, mix with, and bind the harmony.

Discords are introduced in composition several ways.

First, When the notes passing in the natural order, two, three, or more of one part are set against one of another part. This passage of the notes is said to be by diminution; as in the following example.

Example of discords in passage by diminution. No. 69.

When the treble descends, the discords descend likewise into the concords; that is, the 9ths pass into 8ths, the 7ths into 6ths, and so forth. The same thing happens when the bass ascends.

When the treble ascends, or the bass descends, the contrary happens; that is, the 2ds pass into 3ds, and the 7ths into 8ths, or the discords into concords, according to the natural numbers.

When a single discordant note is set, the change of that note into a concord is properly called the passage of the discord.

When the accompaniments are set along with the discordant note; that is, when the whole discord, either in composition of many parts, or in figures in the bass, is expressed, the change of the same into a concord is justly called the resolution of the discord. The passage of the discord in single notes moving according to the natural order, as in the last example, is evident.

The accompaniments and resolution of the whole discord depend on certain principles; on which we shall, in its place, demonstrate the same.

To proceed, then, on single discords.

The second way in which discords are used in composition is, when the notes of each part move alternately, a long note between two short ones, so that the note of one part breaks off and ends in the middle of the note of the other part. This is called syncopation or binding; for the frequent mixture of the discord here supports and binds the harmony;

As in this example. No. 70.

In this manner the air of either part is less constrained, by the constant return of the discord, and passage into the concord. In some places this happens by the natural suc-

cession of the notes by diminution, as in the first example, though not so frequently as in the last manner by syncopation. But there is a passage of the discord into the concord, formed by the notes moving by greater intervals,

This musick is preferable on account of the great variety produced by this unexpected, and, we may say, surprising mixture of the discord and harmony. For variety itself causes new pleasure, when it is least expected, or when attended by novelty.

This moving of the notes by greater intervals, is the third way of introducing discord; and is the effect of the discords and concords constantly meeting by contrary motion of the parts.

In this manner the variety arises from the passage into concords, different from those which must succeed, either in the natural order of the notes, or by syncopation.

The variety also is greater by the constant succession of discord and harmony almost through every note.

For here the composer is at liberty to pass into any concord he pleases; and to resume any discord. For as the passage into the perfect concords, between two parts, cannot be effected, but from the nearest discord, when the notes move in the natural order; so, when the notes move by greater intervals, there is opportunity for many passages, which could not take place in any other way.

All this will be evident, when we come to understand the resolution of the discords.

Example of the more perfect mixture of discord and harmony. No. 71.

In this example are set forth the two first ways of using discords; namely, by diminution and syncopation, as well as passing by greater intervals; being set according to the rules relative to each manner. Where the discord and harmony move by greater intervals, there the passage is from discords new and unpractised in the other two.

The composition, where this liberty is taken, does most justly challenge the name of ornamental or figurate descant.

And the musick, wherein the discord is used these three several ways in their turn, must be esteemed the best, as exhibiting greater variety than could be expressed the other ways only. Let it be remarked in this place, that this new passage of the discord is effected by both parts generally moving by a semitone; the power of which will be seen when we shall have demonstrated the accompaniments and resolutions of the whole discord.

There is a fourth way wherein discords are admitted in composition. This is when discords succeed each other; or, where there is no passage into a concord. This is setting discords note against note. It is to be done two ways. First, when the discord passes into one of another denomination, in the natural order of the notes, by contrary passage of the notes of each part, of the same or nearly equal quantity.

This passage of the discord is necessary, as we cannot ascend or descend by the degrees of a great interval; but the intermediate discords will take place, and thence oftentimes two will succeed each other.

This

This liberty is to be used chiefly in short notes, and by diminution.

Example of discords succeeding each other, or set note against note. No. 72.

Secondly, Discords are admitted, note against note, when the same discord is often repeated. This liberty is taken with the discord of the flat 7th above all others; and is most justly practised in musick of three parts. When this discord is brought in successively in two parts, the complement of the chord ought to be written in the treble.

Example of the discord of the flat 7th successively. No. 73.

This example is taken out of the eleventh sonata of Corelli's fourth opera.

In this example, it is, remarkable, that the first and second trebles furnish by turns the discord to the bass; which constantly descends by a 5th, while the intervals of the upper parts are 5ths and 4ths to the bass alternately. Observe, when the note in the bass is flat, the discord will be the sharp 7th.

The imitation of this passage may be learned by inspection of the example. The demonstration depends on the demonstration of the third resolution of the discords following; which we must therefore reserve for that place.

An example of this passage shall be given when we come to teach the use of discords in musick of three parts.

Having done with the single discords and their passages, we proceed, in the next place, to the complex ones; by which are meant the same discords with their accompaniments and resolutions.

Now, as, by axiom the second of the theory, from the natural order of notes, the properties, proportions and relations of sounds, which arise out of their various combinations and successions, are deduced; we shall demonstrate the properties of the discords upon the same principle.

The first property of the discord is the notes which are to be played in the thorough bass, in concert with the discord. These notes are called the accompaniments.

On the exact knowledge of these depends the second property of the discord; namely, its passage into a succeeding concord.

This passage is called the resolution of the discord, as mentioned above.

Each discord hath its own distinct properties. Therefore the definition of discord already given is just; where it is said, that discord consists in certain variable proportions of the distance of sounds,

As two single notes standing at a certain interval, form the discord, so they may easily be resolved into the proper succeeding concord, as we have already shewn.

And on instruments which have not keys, no more than the two notes can well be performed. Yet, as the resolutions of the discords cannot be demonstrated without the knowledge of the accompaniments, we shall consider the whole discord together; and demonstrate the accompaniments of each particular discord, after the same method we have proved the harmony of each note of the octave in counterpoint.

**THEOREM.** Since every interval in musick is discord or harmony, the accompaniments of most discords will be harmony in themselves: for thus they will be discord to the given note. But it will also happen, that some note of the accompaniment in other cases will also be harmony to the given note, yet the whole accompaniment discord in itself. For the soul so accords with harmony, as not to bear an entire perfect discord.

Now, as more or less of discord with the given note prevails; so the discords are naturally divided into proper and inharmonic.

A proper discord is the concord of some member of itself, and only discord in part with the bass or given note.

An inharmonic discord is an absolute discord in itself, and partly concord to the bass or given note.

There are five proper discords; namely, the lesser and greater 2d, the sharp 4th (or flat 5th,) the sharp 7th, and the 9th.

There is one inharmonic discord; which is, the flat 7th. It hath three places in the compass of the octave; where it appears in three different forms.

It is called inharmonic; not only because it is an absolute discord in itself, but also because it is not the accompaniment to the bass note, from whence the order of the discords is traced in the natural series; except in one place or form, which is the second; wherein the flat 7th is the uppermost note of the chord. This will be seen most clearly, when we shall have gone through the discords of each kind in their natural order, in the table of discord and harmony. No. 82.

We proceed therefore to the demonstration of the discords. And, according to the 2d axiom of the theory, shall begin with the demonstration of the accompaniments of the 2d.

As in the demonstration of the concords we begin with the key-note, which we considered as an immoveable point, from whence our calculations were to proceed; so we shall here consider the bass, or lower-note of the discord, that immoveable point; and the upper discordant note the interval in question, whose properties are to be found.

#### *Demonstration of the accompaniments of the 2d.*

The accompaniments of the 2d are the 4th and 6th to the bass or given note, or the discord of the 2d is the concord of the same.

The 2d is a proper discord: Therefore the accompaniments of the 2d are its 3d and 5th. But the 3d and 5th to the 2d, or discordant note, are to the given note the 4th and 6th; therefore, the accompaniments of the 2d are the 4th and 6th.

Example of the first discord, or discord of the 2d. No. 74.

#### *Proper discord.*

The discord of the 2d must be a proper discord: for the 3d and 5th to the bass with the 2d would be intolerable discord, seeing they are three notes in the natural order, and the 5th and 7th is the harmony of the 2d; therefore they must be the 6th and 8th, which is the given

ven note : But the 6th will have the 4th ; therefore the discord of the 2d is a proper discord.

By the 2d axiom of the theory, the properties, proportions and relation of sounds are deduced from the natural order of the same. Which axiom is extended to the discords, as they are combined of the natural notes, and differ from the concords only in form.

On this axiom, then, we are to investigate the next succeeding discord. The 2d discord is the 2d, 4th, and sharp 7th to the given note. For these are the next succeeding discordant notes.

*Demonstration of the second discord.*

The 2d and 4th cannot have the flat 7th ; for they are harmony, or concord of the flat 7th ; and the 8th is the given note : therefore it remains, that the second discord is the 2d, 4th, and sharp 7th to the given note.

Example of the second discord. No. 75.

*Inharmonic discord.*

This is an inharmonic discord ; being an absolute discord in itself. It hath but one concurring note with the bass ; which is the 4th. This 4th is the flat 7th to the given note's 5th : which 5th is the bass to this discord ; the given note in this place being considered only as a point, or unity, from which we are to investigate the next discordant notes, according to the 2d axiom.

The property of this inharmonic discord, or flat 7th, is, that its own discordant interval, or that which is formed by the accompaniment, is always a sharp 4th, or flat 5th, which distinguishes it at sight from every other discord. And every inharmonic, where-ever found, hath the same property. The resolution also of every inharmonic is the same ; as we shall see, when we come, in the next place, to shew the resolutions of the discords.

The next discord, according to the 2d axiom, is the sharp 3d, 5th, and flat 7th to the given note. This is also an inharmonic, or flat 7th ; and having the same property with the former, namely, the flat 5th, must not be accounted a new discord. No. 76.

*Inharmonic discord.*

This is the inharmonic discord in that form, whose accompaniments are relative to the bass, or given note.

The third discord is the 3d, 5th, and sharp 7th to the bass, or given note.

*Demonstration of the third discord.*

The sharp 3d, 5th, and sharp 7th, must constitute the next discord. For the flat 3d, 5th, and flat 7th, are harmony, or concord of the flat 3d ; and the 8th with the 3d and 5th, are the chord of the bass note ; and the flat 7th, with the sharp 3d and 5th, are the inharmonic last mentioned ; therefore, the sharp 3d, 5th, and sharp 7th, are the 3d discord.

Example of the third discord. No. 77.

*Proper discord.*

This is a proper discord, being the concord of the 3d to the bass ; and the sharp 7th the discordant note.

To proceed then according to our 2d axiom, the next

discordant notes in order, are the 4th, 6th, and 9th : But these being the notes which constitute the first discord, varying only in place and name of the 9th, for the 2d, are in effect the same discord.

The next successive discordant notes are, according to our well known axiom, the 4th, sharp 7th, and 9th. But these likewise constitute the 2d discord in like manner, as was said in the former case ; and therefore cannot be reckoned a new discord.

To proceed then by our axiom : The next ascending notes, by the smallest intervals, are the sharp 4th, 6th, and 8th. This is an inharmonic, or flat 7th ; its flat 5th being formed by the sharp 4th and 8th ; therefore no new discord. No. 78.

To go on, the next discordant notes will be found the sharp 4th, 6th, and 9th.

*Demonstration of the fourth discord.*

From the proof of the last inharmonic discord, the sharp 4th and 6th can form a proper discord with no other interval but the 9th ; for the 7th would produce three notes in the natural order, and intolerable discord. Therefore the fourth discord is the sharp 4th, 6th, and 9th.

Example of the fourth discord. No. 79.

This is a proper discord, being a concord in itself, and only discordant to the bass note. The discordant notes of it are the sharp 4th and 9th.

The next which presents itself, is the 5th, sharp 7th, and 9th, by the same axiom.

*Demonstration of the fifth discord.*

The 5th will admit no other discordant notes but the sharp 7th and 9th. For the 8th and 10th make the concord of the bass note ; and the sharp 7th and 10th is, with the 5th, the third discord already proved ; and any other note would be double discord, and intolerable : therefore, the fifth discord is the 5th, sharp 7th, and 9th.

Example of the fifth discord. No. 80.

*Proper discord.*

This is a proper discord, being a concord in itself ; and discordant only with the given note. Its discordant notes are the 7th and 9th.

We have purposely reserved the discord of the lesser 2d to the sixth and last place, 1st, Because, as the interval next above the key is always a whole tone, we cannot, according to our 2d axiom, erect this discord as relative to the given note, or key ; as we have done the other five. 2dly, The resolution of this discord will be found different from that of the greater second ; for reasons which will abundantly appear, when we speak of the resolutions. This discord may properly be called the discord of the semitone.

*Demonstration of the discord of the semitone.*

The discord of the semitone, or lesser 2d, is, like that of the greater 2d, or whole tone, the 2d, 4th, and 6th. The demonstration is the same as that of the greater 2d, and therefore need not be repeated here.

Example of the sixth discord. No. 81.

This is a proper discord, like that of the greater 2d, being

being a concord id itself. Its note discordant with the bass is the 2d.

It hath been said, that all harmony is divided between the flat and sharp keys.

The mixture of discord and harmony enables us to extend the like observation in this place much further.

Hence the following corollary.

The composition of all musick, of any number of parts whatever, is divided between the harmony of the flat and sharp keys, and the just mixture of discord with it.

To illustrate these truths, we shall set in one view every concord and discord, in the whole compass of musick, in their natural order. No. 82.

Hence we shall derive some useful corollaries, which will lead us to discover what is next to be considered, the second property of the discords, or their resolutions into the concords.

The manner of reading this is as follows :

This concord is the concord of the key.

This concord is the concord of the 2d to the key, or given-note.

This concord is the concord of the flat 7th.

This discord is inharmonic, and so forth : descending still from the uppermost lines of harmony, or discord, to the lowest line. or bass.

In this view is seen the mixture of discord with harmony, each in the natural order. Wherein, indeed, nothing regular or proportioned appears to sight. The reason of this is evident from the demonstration of the harmonical proportions. For, if they be of a species different from all other proportions, as by corollary 2d of the theory, and must be demonstrated on principles peculiar to them ; then the succession of the discords, constantly taking place between the intervals of harmony, must be disproportioned too. This appears to sight in the next example, or view of harmony and discord in the natural order. No. 82.

However irregular this may seem, an uniformity prevails through the whole, which supports that variety in musick so desirable : Without which variety, there could have been but one concord among sounds ; a sameness prevailing through the whole ; without semitone, and consequently without discord. In this case, musick never could have existed as an object of pleasure to the sense ; much less of science.

This admirable structure is raised on the power and property of the semitone, which shall be the subject of the following corollaries.

COR. I. Every semitone in the octave hath either a concord or discord proper and peculiar to itself. Yet, the natural succession of the concords and discords is not according to the ascending and descending semitones. For, it is evident, in the annexed table, that the corresponding bass notes constantly descend by 3ds, the variety, at the same time, shining throughout the harmony and discord in the upper parts, ascending by semitones. Yet the bass expresses every semitone in its passage by 3ds, uniformly to its period.

This most strongly illustrates the truth of the 4th axiom of the theory ; namely, that the concords and discords,

either in their natural order, or arranged by art, will not suffer us to depart from the established precept of variety amidst uniformity.

The same uniformity, or rather unity, is exhibited still more plainly in the 5th discord, in the coincidence of discord and harmony in the same individual sounds.

For this discord, which is the discord of the 9th, is also the harmony of the 5th.

This is truly admirable, and furnishes us with the most interesting remark in the compass of musick, as in the following corollary.

COR. II. The scope of musick, and motion of the parts, must at length terminate, and meet in one invariable thing HARMONY.

Thus are we arrived at the full extent, or bounds of musick. It is fit we now return to make such further observations as will lead us to the knowledge of the resolutions of the discords, which is the next thing to be spoken to.

The division of discords into proper and inharmonic, we have made for the sake of clearness and method. The difference already pointed out between the discords must be remembered ; which is, that the property of the inharmonic, or flat 7th, (which note does ever, with another note of the chord, frame the sharp 4th, or flat 5th) is the same, in whatever place or form it is met with ; whereas the proper discords essentially differ from each other, and in every particular.

The three inharmonic therefore, in the natural order of the discords, are not so properly three, as the same discord in different light ; where it is a preparation for a close on the key, and on the 4th and 5th to the key.

The bass to the discords moves by 3ds descending in a sharp key.

The notes of the bass, corresponding to the proportions of the flat key, have no relation to the discords in the line next above ; but are the bass to the concords in the flat key, as demonstrated in the rules of harmony.

The two discords, which are a repetition of the first and second, are set down in compliance with the 2d axiom, to pursue the natural order. And hence they serve to demonstrate there can be no other discord than those exemplified in the scheme. For there is no semitone in the octave which doth not appear there to have its discord or harmony connected with it.

In this scheme then is comprised every interval of musick, with the members of each chord respectively, both discord and harmony, in the natural order.

From the same order, we shall demonstrate the passage of the discords, into the concords or resolutions of the same.

In the theory, it hath been said, that the semitone is the principle or hinge, on which turns the resolution of every discord.

On this principle, then, we shall now demonstrate the same.

The discords stand in the natural order between the concords ; but every note of the chord is not equally near respectively.

From the idea of harmony, which is fitness or proportion,

tion, the passage of the discord must be to the nearest concord; therefore, the resolution will be by the smallest interval, that is, by the semitone.

This is the general theorem for the resolution of every discord. We will now apply it,

The resolution of the discord of the 2d is into the concord of the given note.

The 4th, or semitone, will move into the 3d, but the 3d will have for harmony its 3d; therefore, the 6th must descend into the 5th, and the 2d's passage by the nearest interval will be into the given note. By these passages is formed the chord of the same; therefore, the resolution of the discord of the 2d is into the concord of the given note.

In a flat key, there are two passages by semitones; that of the flat 6th into the 5th, and of the 2d ascending, by contrary motion, into the 3d.

Example of the resolution of the discord of the 2d, or first discord. No. 83.

*Proper discord.*

The resolution of this discord being into the given note, the bass does not move.

The resolution of the second discord is into the concord of the given note.

The second discord is the 2d, 4th, and sharp 7th. The sharp 7th and 4th move by the semitones and contrary motion into the 8th and 3d, while the 2d falls a 5th into the 5th. These are the concord of the given note: therefore the resolution of this discord is into the concord of the given note.

Example of the resolution of the second discord being inharmonic. No. 84.

*Inharmonic discord.*

The resolution of this discord being into the concord of the given note, the bass ascends by a semitone.

The passage of this inharmonic by contrary motion of two semitones, and the other note falling a 5th, is the resolution of every inharmonic, where-ever introduced. This therefore needs no repetition. But if the succeeding concord has a flat 3d, the passage is by two ascending semitones; the 2d rising into the 3d, the 7th into the 8th, and the 4th by a whole tone into the 5th. This movement can only happen in the resolution into the key.

The other, of much more extensive use, is the true resolution of the inharmonic discord; and more interesting, as, by its contrary motion of the semitones, it better binds the harmony.

It is necessary here to explain further the nature of the inharmonic discord.

The inharmonic discord, then, is always the chord in a sharp 3d, with a flat 7th; which two notes frame the interval which characterises this chord, namely, the sharp 4th, or flat 5th: when the flat 7th is the upper note of the two, the interval is the flat 5th; when the sharp 3d is the upper note, the same interval is called the sharp 4th. These notes being relative to the fundamental note either of them determine the chord.

As the inharmonic is found in different places of the octave, so consequently the note of the chord must vary accordingly; the second inharmonic therefore only, in the

natural order, hath reference to the given note in the table, as that happens to be the note of the chord. For the given note there is to be accounted only a point or unity, from whence we proceeded to trace the discords in their natural order, as they lie between the concords. The chord note, therefore, of the first inharmonic is the 5th to the given note; and of the last inharmonic, it is the 2d to the same. Now, as the whole chord falls a 5th in the resolution, so the first is a preparation for a close on the key, the second for a close on the 4th, and the last for a close on the 5th; now, as any note of the chord may stand in the bass, so the third is often preferred before the chord note, for the sake of the movement of the bass by a semitone, as well as because falling a 5th in the bass is more properly the part of harmony.

The flat 7th is likewise chosen for the bass note; for the same reason, the movement of the bass by a semitone descending; which is no inconsiderable use of discords. For in figurate descant, as we have said, all the parts move more freely.

The next discord is likewise inharmonic. It is the sharp 3d, 5th, and flat 7th to the given note; which note is likewise that of the chord. No. 85.

Note, the resolution of every inharmonic being into its 5th below the chord, the resolution of this will be into the 4th of the given note; as rising a 4th, and falling a 5th, answers the same thing in estimating the intervals of harmony.

*Inharmonic discord.*

Example of the second inharmonic discord and its resolution: here the bass note is the note of the chord; therefore, in the resolution it falls a 5th, which is the 4th to the given note.

The flat 7th descends by a semitone into the 3d, the 3d rises by a semitone into the 8th, and the 5th falls a 5th into the 5th of the concord. The resolution therefore is into the 4th of the key.

This is that form of the inharmonic discord on which the composition of the passage taken out of Corelli, (No. 73.) is grounded. Observe, that in the cited passage, and also in every like passage, the two notes of the bass move to only one note of the second part, which becomes the flat 7th by this movement of the bass.

Thus the flat 7th is given, in the upper parts by turns, to every note in the bass, as hath been before remarked.

*Resolution of the third discord.*

The third discord is the 3d, 5th, and sharp 7th, to the given note; it is resolved into the 6th to the same. For the 7th ascends into the 8th or 6th's 3d, the 5th rises a whole tone into the 6th, and the 3d not moving becomes the 5th. The resolution of this discord therefore is into the chord of the 6th.

Example of the resolution of the third discord. No. 86.

*Proper discord.*

This is a proper discord; in the resolution of which the bass falls a 3d, while the whole discord falls a fifth.

The

The next discord is the sharp 4th, 6th, and 8th. It is inharmonic. Its resolution is into the chord of the given note's 5th. No. 87.

*Resolution of the third inharmonic discord.*

Of this discord the bass note is the flat 7th; it descends by a semitone, while the whole chord falls a 5th.

*Inharmonic discord.*

Its resolution is the same as that of every inharmonic, in what form soever, by the contrary motion of the two semitones, while the third note falls a 5th.

*Resolution of the fourth discord.*

The fourth discord is the sharp 4th, 6th, and 9th. Its resolution is likewise into the chord of the note's 5th.

For the sharp 4th ascends into the succeeding concord's 8th, the 6th passes into the 3d, and the 9th not moving becomes the 5th. Those are the chord of the note's 5th.

Example of the resolution of the fourth discord. No. 88.

*Proper discord.*

This discord is a mixture of the proper and inharmonic. It is a proper discord, for that the notes of the treble are concord; and inharmonic, in respect of the bass, with which it makes the discord of the sharp 4th.

It differs from the foregoing, where the flat 7th is expressed in both treble and bass; whereas, in this, it is only in the bass.

The bass here also descends by a semitone, while the chord falls a 5th.

*Resolution of the fifth discord.*

The fifth discord is the 5th, sharp 7th, and 9th. It is resolved into the concord of the bass note.

For the 5th is that note's 5th; the sharp 7th ascends by a semitone into the 8th; and the 9th (or 2d) passes into the 3d. Thus it is resolved into the chord of the given, or bass note.

Example of the resolution of the fifth discord. No. 89.

*Proper discord.*

In this resolution the whole chord falls a 5th, while the bass stands still, or descends into the octave.

This is plainly the last discord in the order of sounds. Its resolution is into the given note or key, by the passage of the great cadence, or descent by a 5th. It is a concord in itself; and is in harmony the concord of the 5th.

In this chord discord and harmony are united. When it stands in discord with the bass, the bass doth not move in the resolution; when it sounds perfect harmony with the bass, then the bass descends a 5th.

Therefore we conclude, Harmony and discord are like two finite lines, whose beginnings are at a certain distance; and in the natural progression converge constantly, until they meet in a point.

The discord, which we have reserved to the sixth place, is that of the lesser 2d, or semitone.

Its places in a flat key are the 3d and 6th; and in a

sharp key the 4th and 8th, or where-ever a new semitone is introduced.

It is a proper discord, being a concord in itself, whose chord hath always a sharp 3d.

Its properties are everywhere alike; but its resolution differs from that of the greater 2d, for the reason assigned in the resolution of every discord; that is, the passage by the semitone.

*Resolution of the lesser 2d, or semitone.*

The discord of the lesser 2d is the 2d, 4th, and 6th to the bass; or, the concord of itself.

Its resolution is into the concord of its own 3d or 5th. It rises into the concord of its 3d by the single passage of the semitone descending. And into the concord of its 5th by the 4th descending along with the semitone.

Example of the resolution of the discord of the semitone. No. 90.

In the first resolution, the chord rises a 3d, and the bass falls a 5th. In the second, the chord rises a 5th, and the bass falls a 3d, the reverse of the former.

From the resolutions of the discords we derive the following corollaries.

**COR. I.** There is no interval of harmony that is performed by the bass in the resolution of one discord or another.

Hence we may conceive that harmony regulates even the discords, and presides in every part of musick.

**COR. II.** The inharmonic discord, or flat 7th, is a preparation to a close on a key, the 4th and 5th, flat 3d and flat 6th; for into the harmony of these it is resolved; they being the intervals on which closes may be made according to the established rules of melody. And universally, wheresoever a close may be made by introducing a new semitone, the preparation may be made by the flat 7th, or inharmonic discord.

This discord, being of such extensive use, will deserve some further remarks, which may render the setting of the same more easy, and assist the performer in the taking and resolution of it.

In the inharmonic discord, then, are three notes chiefly concerned, which are the note of the concord; its 3d, (which is always sharp;) and the flat 7th: either of these may be set in the bass. Hence there will arise three varieties.

If the note of the chord be the bass note, the figure is the flat 7th; the chord is that of the same note; and the bass falls a 5th.

Secondly, When the 3d is the bass note, the figures are flat 5th and 6th; the chord is that of the 6th to the same 3d; and the bass ascends by a semitone.

Thirdly, If the flat 7th stand in the bass, the figures are the sharp 4th, 6th, and 9th; the chord is that of the 2d to the bass note; and the bass descends by a semitone.

*Example. No. 91.*

The 5th of the chord may likewise stand in the bass; but as the movement of the same is by a whole tone descending, it is very seldom used.

The figures are sharp 6th.  
flat 3d.

COR. III. Hence the bass ascending or descending by a semitone, furnishes an opportunity of introducing notes in the upper parts, which will constitute the inharmonic discord.

And again, the sharp 3d of any chord in the treble, or any note having the addition of a sharp, and thereby becoming the greater 7th, may be the 3d of an inharmonic; the bass taking the flat 7th. For the sharp 3d of the chord, (which is the sharp 4th to the flat 7th in the bass, or elsewhere,) and the flat 7th, in whatsoever part they are set, in bass or treble, or both in the treble, constantly move each his own way; the first ascending, and the latter descending by a semitone.

These are the simple discords as they are found to lie in the natural order of sounds between the concords; whose accompaniments are, for the most part, harmony among themselves. It is evident, from the method in which we traced them, that there is no other discord among sounds. Notwithstanding, from the combination of two simple discords, a new form of discord may be framed, which taketh part of the inharmonic and discord of the semitone; which, therefore, we call the compound discord.

This discord is the sharp 3d, flat 7th, and flat 2d, or semitone to any note whose chord hath a sharp 3d.

It is resolved, by the passage of three semitones, two descending, and one ascending, into any concord with a sharp 3d; and therefore may be introduced as a preparation to any concord, in either flat or sharp key, where the greater 3d is.

Example of the compound discord, and its resolution. No. 92.

The resolution of this discord, as it is compounded of the discords of the flat 7th, and semitone, will partake of the resolution of the same. Thus the upper note, or semitone, descends into the 5th of the concord; and the flat 7th and 3d meet by contrary passage of a semitone each into the 3d and 8th part of the resolution of every inharmonic, while the bass descends a 5th. Thus the passage into every note of the concord is by a semitone; so great a favourite of nature is the semitone.

By changing the form of this discord, it will be resolved into a chord with a flat 3d, by one semitone descending, and two ascending; the two extreme notes of which are the same as in the example above; but the middle note is the 5th ascending into the 3d, instead of the flat 7th descending. The upper notes therefore form the flat 5th, or inharmonic interval. No. 93.

The properties of those discords, and of the inharmonic, furnish us with some practical observations; which are, that the two discordant notes of these discords are, in musick of two parts, a preparation to, or pass by contrary motion of the semitones into the concords of the sharp 3d, flat 6th, and 5th. When the flat 7th is the uppermost note, and the lower the sharp 3d, they pass into a sharp 3d.

When the upper note is the sharp 3d, and the flat 7th is below, they pass into the flat 6th; so do likewise the flat 7th above, and the chord note below.

Lastly, the two extreme notes of the compound discord pass into the concord of the 5th.

Example of the passage of discords in musick of two parts. No. 94.

In like manner there is a passage into the octave from a discordant interval; the upper note of which is part of a concord, and the lower the semitone of the compound discord. No. 95. Or the contrary.

There is no passage by two semitones into the flat 3d and sharp 6th from any discordant interval, except the semitone. For, in the passage of quick notes encountering each other by contrary motion, this, or any other discordant interval, may fall into the concords. But such, being tolerated only for their quickness, need not be reduced, as indeed they cannot, to any rules of art.

Lastly, the bass will admit two notes together, each concurring with it, namely, the 5th and 6th, and making a discord between themselves.

This discord, which differs from the proper and inharmonic, is rightly called the mixed discord; each of the two notes being in harmony with the bass, and discordant to each other.

The framing of this discord depends upon the rules of harmony, and may be set to any note of the bass which hath for harmony its own concord, and is likewise the member of another.

Therefore, in the sharp key, the key and 5th, and in the flat key, the key 3d, 5th, and flat 7th, admit a 5th and 6th.

When we shall have proved, under the article of transposition, the 4th in a flat key, and 6th in a sharp key, to have their own concord; they will be found, no doubt, to have the privilege of admitting a 5th and 6th.

For thus it is understood. The key hath a 5th in its own right, and a 6th as member of the 4th.

The 5th hath a 5th in its own right, and a 6th as member of the key.

The flat 3d hath a 5th in his own right, and a 6th as member of the key.

The flat 7th hath a 5th in his own right, and a 6th as member of the 3d.

Thus the 5th and 6th will stand together to the bass.

The properties of sounds in the natural order may be transferred by art, and improved into all the variety possible; as this is no other than an imitation of nature.

Hence we infer, that every note, which assumes the nature of the key, by the addition of the greater 7th, will admit a 5th and 6th.

This 5th is easily distinguished from the 5th of the inharmonic, which is always an imperfect one, and ought constantly to have a flat prefixed.

Now the chord of the inharmonic with a flat 5th is that of the 6th to the bass note, as hath been said. But the chord of the mixt discord may be better understood to be the chord of the bass note, with a 6th added.

## SECT. 2. OF FIGURING the BASS.

HAVING delivered all that hath fallen under our observation concerning the nature, proportion, and use of discord; we shall now make an application of the same, in order to explain the figuring of the bass; the next article proposed to be spoken to.

First, Of figuring the concords.

That

That the notes whose harmony is their own chords, need no figures, is evident from the definition of harmony; which consists of one certain, invariable proportion of sounds.

These are the key, flat 3d, 4th of a sharp key, 5th, flat 6th, flat 7th.

They which, as members of other chords, require the figures of harmony set over them, are these following; and are reduced to this general rule:

The 3d of every concord hath a  $\frac{6}{4}$ ; and the 5th of every concord hath a  $\frac{6}{4}$ .

Therefore,	And these,
Key	Key 2d
Flat 3d and sharp	Flat 3d and sharp
5th of a flat key	4th of a flat key
Flat 6th and sharp	5th of a sharp key
Sharp 7th	Flat 7th

have a  $\frac{6}{4}$  have a  $\frac{6}{4}$

Lastly, The 4th in a flat key, when it has its own chord, must have a 5th set over it, to distinguish the chord from that of the flat 7th. And the 6th in the sharp key, when it hath its own chord, must have a 5th likewise set over it, to distinguish the chord from that of the 4th.

The proof of the 6th in a sharp key, having for harmony its own concord, depends on the relative proportion of the flat and sharp keys; as will be shewn in the chapter on transposition. So much for figuring the bass in concords.

Let us now inquire into the shortest and clearest method of figuring the discords. This will be no difficult matter, when we consider well the whole discords, as they are full figured in every example.

These the figures set over the bass express the intervals which the notes in the upper parts form with them. These taken together make the whole discord. And as these, with the harmonic chords in succession, express the whole composition, they are therefore called the thorough-bass.

To render the performance of the thorough-bass easy and expeditious being the chief intention of figuring the bass; this will be best answered by distinguishing the discords, which have some figures in common with each other, by such figures only as will strongly mark each discord. For though all the figures set down in the examples be necessary to demonstrate the properties of the discords, and truth of the composition; the case is quite otherwise in respect to the sight; many marks causing perplexity and confusion, when one single mark in this, as in all other cases, best discovers the difference. The proper discords then being concords in themselves, the figure, or figures, discording with the bass note, will distinguish each of these.

The inharmonic discords being the same in different form, will be distinguished by the discording figures peculiar to each form.

Of the properties of this discord, and manner of taking the same, we have spoken sufficiently. We shall therefore only set down the discording figures of each form, in the following example.

Example of the proper discords figured for taking the same at sight. No. 96.

The inharmonic discords figured for taking the same at sight. No. 97.

Moreover, the proper discords being concords, each in itself; every discord will be concord to some note different from the bass, or discordant note.

To remember this note will render the taking of this discord ready at sight, it appearing in this light a chord of harmony.

The same is in some measure true of the inharmonic discord.

Therefore the figures in the examples, under the bass lines, express the names of these concords relative to each.

It remains to be observed, that the accompaniments of the 2d are the  $\frac{6}{4}$ , and of the 9th the sharp  $\frac{7}{4}$ , as they appear in the natural order of the proportion of the same, (No. 82.) It will be necessary to demonstrate here the truth of this.

The 4th and 6th being the accompaniments of the 2d, the fifth and sharp 7th are the accompaniments of the 9th.

For the proportion of the 9th to the 2d (whose 8th it is) is 2 to 1. And the proportion of the 4th and 6th  $\frac{1}{2}$ .

Therefore, by the rule of proportion, say,  
 as 1 :  $\frac{1}{2}$  :: 2 :  $\frac{2}{2}$ ;  
 but the 4th number, or  $\frac{3}{2}$ , is the proportion of the 5th and sharp 7th; (for  $\frac{3}{2} \times \frac{2}{3}$ , give  $\frac{2}{2}$ ;) therefore the 5th, and sharp 7th, are the accompaniments of the 9th. Q. E. D.

The last use we shall mention of the discord is the furnishing the inward parts of musick, in composition of many parts.

As, in harmony, each part of the four takes one of the concurring notes, and hence, by the continual mixture of these by their contrary motion, the composition is framed; so, in figurate descant, the notes of the discord furnish the parts in their turn.

And the same notes, passing by semitones chiefly, form among themselves that resolution which the bass performs alone.

The composer therefore, when, setting a bass, he introduces a discord, is as well prepared for the notes of the other parts in this case as in setting a concord; and if he be well skilled in the resolutions, will with great ease compose the succeeding concord.

For the thorough bass, being the whole composition in one view, the knowledge of the one and of the other must be the same. As, then, he who understands the rules of harmony and the discords, and their resolutions, will succeed with ease in composition; so, on the other hand, he cannot be a skilful composer who is ignorant of the properties of harmonical chords and discords.

One example in three parts, being the same set above in two, will sufficiently illustrate this.

Example of the use of discord in the composition of many parts. No. 98.

#### CHAP. IV. OF MELODY.

HITHERTO we have considered musick in its several parts taken together, or the art of composition. Our next business will be inquire into the method of framing a single part, or making the melody.

MELODY is the air of the uppermost or first part in musick, commonly called the tune.

In a plain song, the air is formed without considering the relation which the other parts, which may be set in composition with it, may bear. For, being first framed, and for the sole end of pleasing the ear and fancy; it must, it is evident, be independent of them.

For as to framing the bass first, and setting the treble to it, there appears no necessity either in reason or the rules of composition; they equally serving the purpose of beginning with any part, no part being privileged with any particular member of discord or harmony; as is abundantly manifest from the various positions which the discordant notes have been shewn to stand in; as well as from the 4th axiom of the theory, which establishes variety for conducting and rendering even harmony acceptable; a sameness in the successive concords being the only thing exceptionable in that part of composition.

All the parts of musick then being equally concerned in the composition; to prefer any one part, as a basis, or unerring guide, on which to erect the musick, or bring in the parts, is doing injury to that liberty which nature and the rules of art put us in possession of.

But the air of the first part so essential to the tune, or rather the tune itself, compels us to decide in favour of framing the treble first. In which it will be found impossible to succeed, when it is confined to what the bass, if it be first framed, must of necessity prescribe.

This preference in framing the treble first, chiefly respects a plain song, or air. For, in more elaborate pieces, where the design of the author is imitation of passages in the several parts by turns, according to his choice or fancy making use of the same liberty, he will take any for the leading part, and accordingly write the passage in that part, and finish the composition in the rest.

The air or first part in instrumental musick is called the first treble; the air for a single voice is called the voice part, or song; and in musick for many voices, the upper part is called the counter-tenor.

In this musick, the air of the tenor, and of every part performed by the voice, is studied with more exactness than the inward parts of instrumental musick.

The reason for this difference is, that in instrumental musick, the first violin generally presides, or leads the musick by its air: as this is the composer's design, the other parts must of necessity be accommodated to it.

Whereas in musick for voices, every voice repeating the same words, that is, expressing the same sense, at the same time, or immediately succeeding; nothing can defeat the end of the musick so much, which is the setting of words, or rather sentiments, to notes as expressive of the sense as inarticulate sounds can possibly do, as for one part to excel the others so much in this necessary point, as by comparison to depreciate, weaken, or alter the sense in the others.

The air, therefore, of every part in vocal musick must be consulted; not only for the sake of harmony, (for a good air in each part improves even the harmony;) but also for the sentiment sake, without which the musick must be absurd and dissonant.

Notwithstanding the liberty which every one may justly challenge of framing an air agreeable to his own fancy; yet it cannot be said, that this liberty is uncontrollable, or beyond the power of art to prescribe bounds to: For then indeed every strain composed by even a bad and injudicious ear might stand in competition with the most finished pieces. But as this will not be allowed on any hand, even an undistinguishing ear conceiving a degree of pleasure in hearing good musick; so there is no doubt but that there must be some precept or manner found out by experience, to ascertain and conduct the air or strain, and which will render it to a good and judicious ear plainly preferable.

The rules therefore which we shall lay down for melody, are such only as are founded in truth and reason; the result of experience, joined to skill; and which are admitted in every liberal art: These are unity, imitation, and order. If it shall be said, that persons unskilled in musick, but otherwise very capable from a natural good ear, will sing an air which an artist cannot find fault with, we confess it may be in some sort true.

But the strains of such composers are always very short; and as they seldom or never depart from the key, so they afford not that variety so desirable in musick: Nay, what is this but saying that the rules of art are conclusions taken from nature, as in truth they are; so then they must be assuredly right? This must be so, when the appeal is made from art to nature.

As to those essays called voluntaries, there was never a good one performed but by a good master. The musick was always good in proportion to the master's skill in the art; in proportion to the variety he introduced according to the rules of art. Therefore even voluntaries are the effects of knowledge and deliberation.

But to return. The first rule of melody is unity.

The unity of tune is said to be in respect of the key, and of the subject.

Every tune must be written in some key, in which it must begin and end.

As every air is said to be in such a key as is the last note, especially the last note of the bass; so there is the same necessity for the first and last note of every air to be some member of the concord of the key. This discovers the design of the author. Having thus fixed the attention of the hearer to this particular, the ear and imagination can no other way be satisfied than by holding to and executing the same design.

The unity of tune is as necessary in this respect, as consistency in the words and sentiments of an orator is requisite to discover the scope and meaning of his discourse.

Secondly, the unity of tune, in respect of the subject, signifies, that there should be one subject of every piece of musick repeated and insisted on, as often as conveniently can be, throughout the whole piece.

And this repetition will be in proportion to the length of the tune, and design of the composer. Even in a minuet, or any other exact piece confined to a certain number of bars, the repetition of the subject may be effected. Now, the subject of every air, or piece of musick, is the first passage of the same, for any number of bars,

bars, be they more or less, as it shall happen; every tune being stamped with some prevailing idea or fancy peculiar to itself, and therefore distinguishing it from every other.

The subjects of grand pieces of instrumental musick are contrived with care and study; and invented with design to enlarge or descant upon at will; not being confined to any length, or certain number of bars. Such pieces, being the efforts of great and masterly genius, afford all the pleasure that design and invention, carried on by every masterly stroke of art, can give.

The second rule of melody is imitation. As in the executing other arts, a similitude and proportion of the members ought to be preserved; so imitation, or a repetition of the most striking passages, answers to this in musick.

Imitation may be performed many ways. First, when the repetition of the passage is made, beginning on the note above the leading note of the passage; or on the third, fifth, eighth, or any other interval.

A passage also may be imitated in any of the descending notes. A repetition on the octave below is frequent in every good author.

In the repetition of passages, there are two varieties.

The first is, when the passage is repeated in notes belonging to the harmony of the key. It will seldom happen in this case, that the passage will in the repetition be precisely the same, in respect of the intervals of the notes, though the movement be an exact imitation.

The reason of this will be evident, if we consider that the intervals in both flat and sharp keys respectively ascend by different degrees; the semitone changing the intervals almost continually.

See example, No. 12. in the theory.

In these examples no more than two flat or sharp thirds succeed each other. And where they do succeed, the semitone is in a different place in the two like intervals of flat thirds; it being the third of one interval, and 2d of the next ascending 3d, or the contrary.

In the sharp key, two sharp 3ds ascend from the 4th and 5th, and is the flat key from the 6th and 7th. The inequality of the flat 3ds, and of the few instances of their succession, is owing to the places of the semitone.

To the inequality of the 3ds is owing the inequality of the 4ths, 5ths, and every other unequal interval in the course of the notes; the greater necessarily partaking of the inequality of the lesser, which is included in it. All this is evident.

Therefore, the repetition of a passage will not be precisely as the passage, except in the places abovementioned; that is to say, a repetition of sharp thirds from the 4th and 5th of the sharp key; and of the same, on the 6th and 7th of the flat key. And in the sharp key, there may be an imitation in the compass of six notes ascending; namely, from the key and its 5th. We have been particular in remarking the want of exactness in imitation on notes belonging to the key. Not that we mean to mark it as a defect; for it is beyond doubt, that every passage in the harmony of the key must be pleasing, whether it be a perfect imitation or not.

Besides, this dissimilitude, arising from the place of

the semitone being changed, is so far from being chargeable with a defect, that, as hath been often said, it produces that sweet variety which is founded in the principles, and which every artist pursuing will succeed in; as in this he doth no other than copy alter nature.

These remarks on the imitation of a passage in the notes of the harmony of the key, will lead us to the second manner of imitation; which is such, as that every note in the repetition stands exactly in the same interval respectively as the notes of the first passage.

This then is a perfect imitation. Which, as it cannot take place in the harmony of the key, except in the few cases abovementioned, it must be effected by art; that is, by altering the places of the semitones in the key, so as to correspond with those in the original passage, by marking a sharp for the semitone ascending, if the repetition be in notes above the passage; and a flat for the semitone removed lower, if the repetition be in the descending notes.

In this manner there can be a perfect imitation of any passage of any length whatsoever, and of any compass: in every instance of which, the key is changed, by introducing notes not belonging to the harmony of the same.

As every interval of the first passage must be preserved in the repetition: it will sometimes happen, that many flats, or sharps, must be added to the notes in the repetition. The rule of this practice will be well understood, when we shall have learned the art of transposition; the repetition of any passage in this manner being no other than a transposition of the same into another key. In regard to this perfect imitation, we have one remark: which is, that if a repetition be made on the note next above, and repeated again the note still higher, it will have a good effect; for this will create such a novelty in the strain as is surprising; besides that it affords the author an opportunity both of making new descant or enlarging on the subject in this new key, as well as of shewing the greatest skill by returning from that digression into the original key with art and propriety.

This will be no difficult matter to one who understands well the art of transposition. Now, the repetition of the subject transposed into a key different from the original belongs to this second rule of melody; as the repeating the subject in its own key respects the rule of unity.

The repetition of the subject after these two manners, and throughout the several parts, as treble, bass, tenor, and so on successively and constantly, each part taking it up immediately, or as soon as the repetition is finished in another, whereby the several parts seem to move in pursuit of each other, is called a fugue.

Musick composed on this design is justly esteemed above all other, not only on account of its excellent contrivance, but for the sake of the pleasure also which it affords.

In a just fugue is represented all the variety possible; at the same time that an uniform progression of the parts is preserved throughout the whole, without the least discovery of the signs of art.

The reason for this may be, that the repetition of so interesting a passage as the subject is, is so natural to the imagination

imagination and ear, as not to be easily distinguished as the effect of art. The construction of a fugue will be understood, from this description, to be in the following manner.

The subject being first written in that part which the composer intends to be the leading part, the same must be set down again in the next part wherein the repetition is appointed to be made, either in unison, or on the 4th or 5th to the key or subject, the 2d, or any other interval; in which matter the composer is at liberty.

Yet the repetition on the 4th seems more natural to the flat key; as, on the 5th, it is to the sharp key.

If the music be in two parts only, the subject being written in each part in succession; the next step will be to frame descant to that part where the repetition is, and which therefore will be written in the leading part. Henceforward the parts move on at liberty, that is, no where repeating the subject, but expressing all the variety in descant each to the other, which the fancy, invention, and skill of the author suggests, until the subject is again repeated, either in the key, or some interval of the harmony of the key, or perhaps in a new key.

The imitation of this must immediately follow in the other part, in unison, or otherwise.

If the music be of three or four parts, let the subject be first written in every part, in succession; and in the order you intend. Then fill up with descant the second bar, or more, of the leading part; that is, as far as the subject reaches in the other part; and proceed likewise on the next repeating part with other new descant; and so on through every part, until all the staves are equally full.

After which the parts move at liberty, as before in a two-part fugue, until another repetition of the subject.

But where, or how frequent, the repetition of the subject may be made; or on what interval, whether above or below; or by what succession of the parts, (for they need not preserve the order they began in;) is neither the business, nor in the compass of the rules of art to prescribe.

In these matters, the composer is as much at liberty as his genius and invention can furnish matter and variety. So that in some places the subject may be repeated continually, in the different parts, on intervals and in a key different from the original key or order.

Sometimes, the movement of the subject being the same, the notes are changed from ascending to descending, or the contrary. Sometimes even the movement to the contrary. At other times, a new subject is introduced; and then it is called a double fugue. And lastly, for the sake of variety, the subject is repeated backwards, or inverted; so that the parts seem to pass each other by contrary motion, instead of pursuing.

In a word, there is no passage which expresses variety, which may not be introduced in a just fugue; while the uniformity is preserved in the imitation of the same, and resuming the original subject, and key, towards the conclusion or close of the piece.

We shall only add, that if the descant which fills up the bars be constantly written in all the parts successively and in order throughout the whole piece, the fugue

is, from the exactness of this repetition, called a canon. In framing of which, observe, that if the canon consist of three or more parts; when the third part takes up the subject, the descant in the leading part must be part of the harmony of the other two.

What remains to be spoken to on this second rule of melody, or imitation, is the method of returning into the original key, after a passage in a remote one. This will lead us to consider the half-tones not belonging to the harmony of the key, or chromatic notes.

For if a passage, or repetition of a passage, be in a new key, which is the imitation we are now speaking of, the resuming the key immediately will be by chromatic notes; descending if the repetition were above; and if the repetition was in notes below the passage, we may ascend into the key by chromatics likewise, or half-tones ascending.

This is evident. For every key, flat or sharp, having its semitones in their proper places, a passage is not in the key, when the semitones are out of their places.

Therefore the returning into the key, from a passage not in the harmony of the same, must be by removing the new half-tones.

This depends on the knowledge of transposition.

The new semitones introduced in a passage, or imitation of one, we have called chromatic notes; because every semitone not belonging to the harmony of the key are to be found only in the chromatic scale.

Yet this is but improperly. For two, three, or more semitones succeeding each other are properly called chromatic notes; which, to music wherein the frequent use of these is made, gives the name of chromatic music.

The use of chromatic notes is to raise the attention by the uncommon and unexpected variety they produce.

For every new half-tone ascending, being understood by the ear as the greater 7th, implies a new key. Three or more semitones ascending after each other, do therefore raise the expectation of so many new keys: whereby the curiosity is greatly excited; and the expectation of the ear being gratified, in the imitation of a close, by every new semitone, the music becomes, as in all other cases where novelty takes place, truly the object of admiration. In a series of semitones ascending, the last is in the place of the key. When chromatic notes descend, the last but one is the key, for the same reason; namely, the semitone below sounding as the greater 7th, every key being a semitone to its greater 7th or half-tone below relatively.

Chromatic notes ascending, by alarming the ear and imagination, elevate the soul, thereby imitating the sublime.

Chromatic notes descending, express the pathetic, which is free from any alarm or terror. The performance of these notes should always be with softness, which naturally removes the apprehension of terror. Ascending and descending semitones partake of the nature of the sharp and flat keys; as hath been said concerning the power of musical sounds to touch the passions.

Chromatic notes may be introduced in many places.

If, in a passage, the semitones of the key occur among others, they are to be accounted as chromatic. Therefore

fore flat and sharp keys are equally capable of improvement by them.

Notwithstanding chromatic notes create so much variety and elegance, it must not be understood that they are to be introduced injudiciously, or without any address; for then they would not only be useless, but injure the music. Chromatic notes being so affecting and expressive, as we have shewn, their place in vocal music will easily be determined by the sentiment.

As, on the other hand, to introduce lively or pathetic sounds, where the sense is dissonant from either, is introducing contradiction and confusion.

Neither is it natural in instrumental music to break in upon a lively strain by slowly-moving chromatic notes. Though at the end of a brisk movement, the transition is good. For music which moves in semitones, though quick notes, must appear slow to the ear, which expects the greater intervals of the diatonic scale, or whole tones.

Yet instrumental music does properly admit the mixture of chromatic notes, when they are accommodated to the genius of the strain or subject. Neither will it be difficult to judge of this propriety. For musical sounds having a natural tendency to express our ideas, the place of chromatics will readily be found by this mark; it being in the power of the composer to imagine ideas without the help or intervention of words, and so substitute these ideas in the place of words, and make them the subject of his strain. Thus he may fill his mind with the imaginary passions of love, sorrow, anger, dejection, pity, and the like; the expressions of which will be most easily distinguished by musical sounds, and varied as the subject requires. Thus, if two or more of the passions, especially contrary ones, be represented by turns, it will form in the imagination a kind of conversation between persons, which never fails to strike the attention stronger, and make a deep impression on the hearer.

Besides this, the imagination of the composer will be assisted in the invention of variety; and the different passages of the piece will be furnished with notes proper and natural to each; for the same reason that choice and expressive words flow in upon a good writer who is master of his subject. We shall only add, that if sometimes the different passages be allotted to the bass and treble by turns, it will greatly diversify the subject, mark the sentiment stronger, and thereby cause new pleasure. So much for chromatic notes. Notwithstanding, what hath been said in this place doth not respect chromatics only; but in general the whole process of an elaborate piece, in every form and transition of the melody; wherein only there is opportunity for application of what we have here suggested.

The reason why we have given place to chromatics under this second rule of melody, or imitation, we have already assigned; namely, that the use of half-tones is necessary where there is a repetition of a passage in another key. For, whatever proportion of sounds is found in the natural order, the same may be transferred by art, and improved upon every occasion, as thereby imitating nature. And this, by the way, is likewise the true reason for the resolution of discords by semitones; being taken from the original pattern, or reso-

lution by the two semitones in the natural series of sounds<sup>s</sup> in the octave.

The third rule of melody is order.

ORDER in music is the conducting the melody or air, according to a certain rule, through several intermediate closes, from the beginning to the final close or end of the tune.

A close is the termination of a passage in a concord; which, like a period in sense, is framed with design, and from the preparation from the notes immediately preceding, which are the whole tone above, the half tone below, and the 5th (generally the bass note) is expected by the ear. This is the description of a full close, which is ever the final close, especially of quick movements. This preparation is the concord of the 5th to the note on which the close is made; the bass making the great cadence, as we have taught in the rules of composition.

This preparation is in full harmony. But it must be remembered, that there is a preparation also from discord; chiefly the discord of the flat 7th, of which we have said enough in the chapter of discord or figurate descant. In slow movements there is a preparation to a full close; which shall be described presently.

Every intermediate close hath its preparation in imitation of the final close, more or less. For there is no necessity for the parts taking invariably the same member of the chord; so that the treble oft times makes the cadence from the 5th, particularly in quick passages; in which likewise, in the middle of a strain, many imperfect closes may occur, the parts taking the notes indiscriminately as they happen, without any preparation designed. It is enough to mention these.

But in order to conduct the air in each strain, if there be more strains than one, with propriety and method, there must be a full close in several places in the harmony of the key. These are called proper closes.

These are also closes made by the introduction of a new semitone, by the addition of a sharp, making the greater 7th not belonging to the harmony of the key. These are rightly called improper closes.

The places and order of both these we shall now assign.

The first proper close falls naturally on the key. This is not meant of the final close; for a close may be made on the key, within a few bars of the beginning; yet this close is seldom made, as not affording variety. Again, the first strain sometimes closes on the key; yet the close of that strain is more properly on the 5th; and the close next after that on the 5th falls naturally on the key.

When a close is made on the 5th, the 4th of the key being removed a semitone higher, becomes the greater 7th by the addition of a sharp. For, in imitation of the final close on the key, there must be a semitone ascending.

Notwithstanding, a close made on the 5th, with a sharp 3d always, from the chord of the 4th in a flat key, without altering the 4th, or bringing in the greater 7th, is accounted an elegance: in which passage the bass takes the flat 6th or 3d to the 4th, and thence descends by the semitone into the 5th.

This is never practised but in very slow movements.

From

From the necessity of a semitone ascending to every full close, except this last instance, we draw this inference, That a close may be made on every semitone in the key. This ascertains the places in both flat and sharp keys: in the closes of both which the key is a semitone; in a sharp key, the 4th also; and in the flat key, the 3d and 6th.

These are the places of proper closes, or such as are made in the harmony of the key.

The order of closes is now to be considered, which, in a sharp key, may be thus. The key, the 5th; the key, the 4th; the 5th, the key.

Notwithstanding, every composer, being at liberty to pursue his own design, will prefer that order which will suit best with the manner of the air, or answer his intention. Our business is only to point out the places where closes may be made, and give a general idea of the order. For we have observed much difference in practice among the best authors; and indeed it cannot be otherwise in long and finished pieces, considering that liberty inseparable from every composer who invents; and therefore every manner which may increase variety, is to be recommended.

The order of closes, then, in the flat key may be, The key, the 3d the 5th, the key.

Or, the key, the 5th the 3d the 5th, the key.

Or again, the 5th the key, the 3d the 5th, the 3d the 6th, the 5th the key.

In pieces of a considerable length, closes may be repeated in these several places, and the succession of them altered from that wherein we have set them down above.

Improper closes, or such as are made on any other note than the key, flat 3d, 4th, in a sharp key, 5th or 6th in a flat key, are made by bringing in a semitone not in the harmony of the key, by the addition of a flat or sharp, the note below the new-made semitone being always the greater 7th, and which thereby determines the note on which the close is to be made.

By this art a close may be made on any note; as on the 2d, 3d, 6th, or 7th of a sharp key; on the 2d, 4th, and flat 7th of a flat key. A close on the 6th of a sharp key is much in use, though no semitone: this depends on the 6th having for harmony its own chord, which will be proved in the next chapter.

It remains to be remarked, that as every new key is formed by the addition of a sharp or flat; so the return into the former key, whether the original, or otherwise, is effected by taking off the flat or sharp from that note, the next time it occurs in the course of the strain.

In musick of two parts, the greater 7th, or that which makes the new semitone, will not in every passage be expressed; the treble sometimes descending from the 3d above into the close. Yet, if the bass falls the 5th, these two members of the chord do properly lead to the close.

However, it must not be understood that in every close the bass must move the same way, by descending from the 5th, as was said before; no part having any member of a chord proper to it by any necessary or natural dependence; for otherwise the second treble, or tenor, could never ascend above the first, nor the bass above either; than which nothing is more common. Custom indeed has appointed to the bass this movement at a close,

for the most part, and especially at a full or final close: and justly; the descending from the 5th, being so interesting a movement, is better expressed, as well as more suitable to the grave notes of an instrument performing the bass.

There is another passage in practice, which, though not a close, yet comes properly in this place to be spoken of. It is a sudden or unexpected stop of all the parts made on a discord.

As this is generally practised in quick movements; so it is often, though not always, succeeded by a slow movement: during this stop, the ear is held in suspense by the discord, and waits for the resolution into the concord.

The suddenness and novelty of this passage recommend it. It seems contrary to a close: for as, being a discord, it hath no preparation, and, not being resolved as soon as the ear expects, seems to lose its connection with the following chord; its meaning therefore is undetermined, and the sense confused: yet it hath a good effect by alarming the imagination, resembling an affected perturbation in the order of the words and sentences of an oration.

#### CHAP. V. OF TRANSPOSITION.

TRANSPOSITION is the removing a tune from one key into another. The use of transposing is to bring a tune within the compass of some instrument, or for the more easy performance on an instrument; some keys being more difficult to perform in than others; especially in wind instruments, as the German flute, &c. For as to instruments that are stopped, as the violin and bass-viol; and instruments with keys, as the organ and harpsichord; all keys are easy to a good performer, who is said to be master of the scale of the instrument.

Secondly, Transposition is absolutely necessary in musick for voices and instruments, when it happens that the key in which the musick is written is too high or too low for one or more of the voices. In this case, the musick must be transposed for the instruments into the key which is nearest to and will best suit the pitch and compass of the voice. For as to the vocal performer, it matters not in what key the musick be written for his part, provided he can sing in the cliff, (or indeed, if he can transpose, as shall be taught in the last chapter, Of singing by note, whether he can sing in the cliff before him, or not,) if the instrument be accommodated to his voice.

There are two ways of transposing. The first is, when the tune is written in another key, at any distance above or below the original, with the proper flats or sharps prefixed. When this is done, the performance on the instrument is easy; the half-tones of the key, and every other, keeping their due places expressed in the writing. This may be called transposition by writing.

The other method of transposing is by the cliff; that is to say, when the cliff is removed, or supposed to be removed, from the place wherein it stands prefixed to the tune.

This removal of the cliff at once transposes the whole, without alteration of the writing: the use of the cliff being, as hath been said, to ascertain the names of the notes. We shall shew both these methods of transposition; and first of transposition by writing.

Transposition

Transposition, in general, is writing or playing a tune in a different key from that wherein it is written, preserving the places of all the semitones.

If the notes in the scale of musick expressed no other than whole tones, transposition would be evident to sight. For a series of tones at equal intervals would, when removed to any distance or interval, preserve their places of themselves (so to speak,) or without the help of art. And the performance of the same on an instrument would be equally easy in all keys; no alteration happening thereby, but changing the names of the notes. And even this would be unnecessary.

The semitones therefore are the causes of any obliquity in the scale of transposition; and therefore the keeping them in their due places is the art we are now speaking of. As it is said in the theory, they are the foundation of writing the same tune in divers keys, which is transposition.

We must have recourse therefore to what hath been said in the theory concerning the essential difference of tone, or the different places of the semitone.

When the first semitone above the key is on the 4th, or 6 semitones to the key; the 3d, which is 5 semitones, is the greater, or sharp 3d; and the tune is from hence said to be in a sharp key.

Again, when the first semitons above the key is on the 3d, or is 4 semitones to the key, that being the lesser or flat 3d, the tune is in a flat key. Again, the next semitone in the sharp key is the 8th; and in the flat key on the 6th.

In every sharp key, the semitone must stand in the same places, that is, the 4th and 8th; and in the flat key, in the 3d and 6th.

The name of the sharp key in the scale, whose semitones are in their places without the addition of flat or sharp, is C. Hence C is called the naturally sharp key. Its semitones are F and C.

This is the pattern for transposing in all sharp keys: chiefly by remembering the letters or names of the semitones.

The key in the scale, whose semitones are in their places without the addition of flat or sharp, is A. Hence this is called the naturally flat key. Its semitones are C and F. This is the pattern for transposing in all flat keys; remembering the names of the semitones.

It may be required to transpose from any key with a sharp 3d, into any other of the same; or likewise from any flat key respectively. Notwithstanding, we shall proceed, according to our method, to shew what are the keys in the natural succession into which a tune will be transposed, beginning at C the naturally sharp key. As the properties of every key will be discovered by this method; so it will answer every thing that can be required in transposition; or shew how a tune may immediately be transposed from any key into any other interval or key that may be required.

For instance, let it be required to transpose from the key of C into that which is next in the natural order of transposition. F is the first semitone in the key of C; which, by the addition of a sharp, becomes F sharp, and consequently the greater 7th to the semitone above it,

which is G. Therefore G is the new key into which the tune is transposed. No. 99. For,

Again, let it be required to find the next key to be transposed into, from the former, or G.

The first semitone in the key of G is C: which by the addition of a sharp, which is removing the semitone, becomes C sharp, or the greater 7th: therefore the new key is D No. 100. For,

Observe that every former sharp which is set down for the tune transposed, is included in every succeeding transposition. That is to say, C, for instance, cannot be marked sharp, unless also F be marked.

The reason of proportion demonstrates this to sight. These are the two semitones of the open keys, as they are termed; the observation will hold true of all others, as will be seen in the following instances.

To transpose out of D into the next key; the first semitone in the key of D is G. But G sharp is the greater 7th to A. Therefore A is the new key. No. 101.

Take notice, that the first semitone, or 4th in the sharp key, being removed by the addition of a sharp; the tune is hereby transposed into the 5th to the key.

This removal into the 5th, by changing the first semitone, being the same in all sharp keys, it need not be repeated in more examples. For the next to A will consequently be E, with the addition of A sharp to D.

The next B with A sharp.

The next will be F sharp with E sharp; never used.

The next would be C sharp with B sharp; never used.

The next would be G sharp with F having two sharps; never used.

The next is D sharp, with C having two sharps; which last is D natural. This key is in frequent use: but the name of the key is changed, and marked with its equivalent E flat: and the name of its greater 7th is likewise changed; and, instead of C having two sharps, is left, as in truth it is, D natural.

The next is B flat; its greater 7th A natural.

The next is F natural; its greater 7th E natural. From this we ascend, according to the rule, by a 5th into C where we began.

Hence it is evident, that of the twelve semitones in the octave, nine are in use as keys with a sharp 3d.

Of which the following are examples in their order. No. 102.

The last three examples marked with flats may be demonstrated in another manner; which is, by changing the place of the other semitone, or 8th, by removing the sharp 7th, by prefixing to it a flat. The transposition will, by this alteration, happen in an inverted order from that in the foregoing examples. For, as the 4th or first semitone in the former manner, being removed by the addition of a sharp, became the greater 7th; so in this case, the greater 7th being removed by prefixing a flat to it, becomes the 4th of the next key. No. 103.

This manner of demonstrating the last three keys is preferable. For, by changing the first semitone, as in the former manner, it doth not so plainly appear, as that depends upon the foregoing key, which never was in use. Besides, the number of sharps to be prefixed to these keys might perplex a beginner in transposing; whereas the

flats, as prefixed in the example, do more methodically follow the removing the greater 7th by a flat.

The demonstration is equally certain and clear in both manners. Let it be remembered, that in transposing, by altering the greater 7th, the key is removed to the 4th above.

Let us proceed to transposition in a flat key: the general rule of which is the same as for the sharp, to remove the semitones, and thereby preserve the proportion of the key.

The different places of the semitone will cause some variation in the effect, or interval of transposition.

Let it be required, according to our method, to transpose out of the open or naturally flat key A, into that which is next by natural succession.

The first semitone in the key of A is the 3d, or C; which, by the addition of a sharp, becomes the greater 7th: wherefore, the new key, or that into which the tune will be transposed, is D. No. 104. For,

Let it be remarked, that the greater 7th which determines the new key in this as well as in the sharp key, is never prefixed to the tune; which to the sharp key always is.

The reason is, that the flat 7th is the property of the flat key. To prefix therefore a sharp to the place of this note on the staff, or beginning of the tune, would be a constant contradiction to all the flat 7ths that may occur throughout the whole air. But the sharp 7th, when brought in at a close, middle or final, or elsewhere where there is no close, is marked particularly as occasion requires.

Another reason for not prefixing a sharp on the staff to the place of the 7th of a flat key is, that, in some keys, the 6th must have its flat set on the staff, or beginning of the writing: a sharp, then, on the place of the 7th would appear a contradiction to sight, and ought therefore to be avoided.

The removal by transposition in the flat key being always to the 4th above, as in the last example, there needs no other example at length of transposition in this key, the same proportion obtaining throughout every key with a flat 3d respectively.

According, then, to this proportion, the next key after D will be G; the 3d of the former, or F natural, becoming F sharp the greater 7th, E flat its 6th.

The next will be C. Its greater 7th is B natural, with the addition of a flat to A its 6th.

The next will be F, with the addition of a flat to D its 6th.

The next would be B flat, with the addition of a flat to G its 6th, never used.

The next would be E flat, with the addition of C flat its 6th, never used.

The next would be A flat, with the addition of a flat to F its 6th, never used.

The next would be D flat, with the addition of two flats to B, never used.

The next would be F sharp, its 6th D, never used.

The next is B, its greater 7th A sharp.

The next is E, from whence we ascend by a 4th into the first key A.

Hence it is plain there are seven flat keys in use, out of the twelve semitones in the octave. Of which the following are examples, with their proper signs prefixed. No. 104.

It may be observed, that by changing the place of the other semitone or 6th, by adding a sharp, the transposition is by two degrees of the former at once; as from A into G, and so on. But this is no more than what hath been done in the second step of this example; yet by putting this sharp to the 6th, it is a short way of transposing into the whole tone below.

It appears from hence, that there are in all sixteen keys in use; a fund for great variety: among which you will observe, that some sharp keys have flats prefixed, and some flat keys have sharps; which cannot by this time appear strange to one who perceives the necessity of preserving the proportion of each, and who must now understand the truth of the 3d axiom of the practice, That no tune composed in a sharp key can be transposed into a flat one, nor a flat one into a sharp; for that would be altering the permanent nature of things.

From comparison of the examples, will be seen what is most worthy of remarking; which is, That whatever sharps or flats belong to any flat key, the same are likewise the property of that sharp key, which is on the same flat key's 3d: for instance, A with a flat 3d, and C with a sharp 3d; so D and F, G and B; and so of all others respectively having the same signs belonging to and prefixed to each.

Hence we collect, that the essential difference of tune consists in the form, that is, the position of the semitone, and not in the materials of musick.

A truth which appeared before in the comparison of discord with harmony; and which will be of great service hereafter, in the art of learning to sing by note.

This inference furnishes us with a proof of the 4th of a flat key, and 6th of a sharp key, having for harmony each his own concord.

A proof which was wanting; as it could not be had from the rules of harmony; neither of these intervals being in the place of a semitone. The general theorem is this: As by axiom 2d the proportion of one single sound is to another according to the natural order of sounds; so the proportion of one chord to another will be according to the natural succession of chords. For a chord is no other than an unity of sounds. But it appears that the succession of chords by transposition in the flat key, is by 4ths, that is, the chord of a note, with a flat 3d; and that of the note's 4th is the same. Now, the harmony of the key or given note is the concord of itself: therefore the harmony of the 4th in a flat key is the concord of itself.

In like manner we demonstrate the harmony of the 6th of a sharp key to be the chord of the same.

And in this the proof lies nearer the truth than in the former case.

For the chord or proportion here is not only the same, but the individual sounds.

For as by comparison, as above, of any flat key with the key of its 3d (which must ever be a sharp key, the flat and sharp 3ds being the compound intervals of the 5th) the

the properties and proportions are not only like, but the same, the difference consisting in the form or place of the semitone; so the chord of one key will be to the chord of the other, not only like, but the same. Now the harmony of every flat key is, by the the rules of harmony, the concord of itself: but the concord of the flat key is the relative sharp key's 6th; therefore the harmony or chord of the sharp key's 6th is the concord of itself.

Let us now apply these rules of transposition to the second rule of melody, or perfect imitation, which is the repetition of a passage in notes not belonging to the harmony of the key; by which notes we understand all that have a sharp or flat added, which was not prefixed to the beginning of the stave or tune.

The general rule of which is, First name the key in which the passage is written, whether the same be the original key, or that of the tune, or some other; then name the interval of the first note of the passage to the same key.

Whatever interval the imitation begins on, whether a 2d, 3d, 4th, 5th, or any other above or below the passage, it bears the same proportion to the key of the imitation as the first note of the passage to its key. Thus

G is to C as A is to D, or  
G : C :: B : E, or again  
D : A :: B : F, or  
D : B :: E : C.

The leading note and key being thus expressed, both of the passage and imitation, shews the proportion of the imitation above or below passage.

If the passage be in a sharp 3d, as the imitation must be so too, the signs, as prefixed to one of the examples of the sharp keys, will be required to be added to the notes of the imitation; and if the passage move with a flat 3d, the examples of the flat key discover the marks wanting in the repetition.

Thus G, the leading note of a passage in C, with a sharp 3d, repeated in the note above; as A and D require two sharps, namely on F and C, the property of D with a sharp 3d.

And the same passage in C with a flat 3d, will in the note above require B marked flat, the property of D with a flat 3d:

And G C sharp 3d, transposed into a 3d, or B E, requires four sharps, on F, C, G, and D, the properties of E with a sharp 3d.

The same passage with a flat 3d, or any other passage, will, when transposed into E, require but one sharp on F:

And D B, with a sharp 3d repeated in E C the natural sharp key, require neither sharp nor flat.

But the same, or any other passage with a flat 3d, will, when transposed into C, have three flats on B, E, and A, the property of C with a flat 3d: and if there be no leading note, as it may often happen, nothing more is to be considered than the key.

Thus the use of transposition in perfect imitation is evident.

The second method of transposition is by the cliff.

The use of the cliff is to ascertain the names of the

notes. Therefore, the names of the notes will be changed by removal of the cliff.

Now as, in transposing, it is necessary that every interval be preserved, or that the semitones keep their due places; so by altering the name of the first note of the tune, by removing the cliff, all the other notes are altered in proportion.

Thus the removal of the cliff effects at once what was done in the other method by the transposition of every single note of the tune by writing.

This way is easier to the writer, but much more difficult to the performer.

Inasmuch as a confirmed habit in any thing is harder to be changed for a new method, than it is to learn by a certain rule at first.

Therefore the performance in transposition by the cliff can no otherwise be attained, than by constant and repeated practice in all the cliffs, and in all such places as they are used to be set for convenience.

Every one therefore who desires to become a master in performance, after he is well acquainted with the three cliffs in their usual places, ought to accustom himself to perform in every cliff, in whatever place it may be set. This knowledge will not only render the performance convenient to his private amusement, by the variety with which he can furnish himself, by playing the same air in whatever key he pleases; but will also make him an useful member in a concert, by transposing at sight, whenever it may be required to accommodate the instrument to the voice. For let it be understood, that to him who is so well acquainted with the places of the cliffs, as to perform in any of them at sight, nothing more is wanting to his transposing by the cliff at sight than to imagine the cliff is prefixed to such or such a place, and commit to his memory the name of the key in which he is to perform, by transposing according to the removal of the cliff which may be most convenient.

This will fix the places of the semitones, or assign the sharps or flats belonging to the new key, as they are set in the example in the first method of transposing by the writing.

Any of the cliffs may be removed; yet the C cliff or tenor is most commonly in use for this purpose.

The general rule for transposition by the cliff is this.

To transpose into any interval above the key, remove the cliff by the same interval descending. And if the instrument be too high for the voice, to transpose into a lower key, remove the cliff to a convenient interval higher.

For, raising the cliff depresses the notes; and, contrary, setting the cliff lower raises the notes, or transposes them into a higher key, in proportion.

#### CHAP. VI. OF SINGING BY NOTE.

THE art of singing by note is founded on the principles and practice of musick. Therefore we have reserved this subject to the last.

To sing by note seems in some respects more difficult to attain than performance on some instruments. In other respects, it is easier and sooner acquired.

The more time is laid out on the practice on some instruments, the more difficult the execution grows, in some sense, that is, according to the construction and compass of the instrument. On the contrary, all the difficulties in learning to sing by note present themselves in the beginning, in appearance greater than they really are; and which a knowledge of the principles of musick, and a little of the practice, with a tolerable good ear, will with ease overcome.

Besides, a little time and experience will convince any one of what compass his voice is, and what degree of performance he is capable of attaining. The principles of singing therefore being well understood, there remains no further difficulty; no one having a right to expect he can execute more than what is within his natural powers.

If this art is not so commonly understood, or the knowledge of it sought, it may be owing to this, that the precepts for learning, or the manner invented, and constantly used, are more perplexed than the subject demands.

How far this may be true, will appear from an observation or two which we shall make on the method now in use.

The art of singing by note rests on these two principles; the finding the places of the semitones, and tuning them and the whole tones of the octave aright.

The first of these has been delivered in the theory; and also in the practice, under the last article Transposition. The tuning the notes is the subject we are now engaged in.

Let us first examine how far these have been profecuted in the present method.

The notes of the octave, besides their names in the scale, have been used to be distinguished by these four syllable, Sol, la, mi, fa; accomodated to the purpose of singing by note, in the following order.

Fa sol, la, mi, fa, sol, la.

Whereof Sol being thrice repeated in the octave, La twice, Fa twice, and Mi once; four syllables expresse the 8 notes.

The art of tuning by these, or assigning the places of the semitones, is by appointing to Mi the place of the greater 7th; and then Fa immediately following expresses the semitone or key, and the other Fa the 4th. How well soever this may answer the purpose of tuning the half-tones in a sharp key; yet in a flat key, the places of the half tones being the 3d and 6th, will, according to this order, be expressed by La, the semitone syllable Fa consequently expressing whole tones.

To obviate this difficulty, and reduce things to order, another place of Mi must be assigned, which is the 2d of a flat key: for this Fa will expresse the semitones on the 3d and 6th.

It is evident then, that before any half-tone or whole-tone can be tuned, the first business must be to find out the place of this mi: now how this can be done by virtue of the sound, or name, or order of these syllables, is not so easy to comprehend.

But admitting the place of mi, or the key, to be known by some previous precept, as indeed ought to be; yet

tuning the key as the first semitone in a sharp 3d, and the 3d as the first semitone in a flat key, is beginning at the wrong end in the first case, and thereby not marking the essential difference of tune, which consists in the flat and sharp 3ds, the order of which is disturbed by this variation of the place of mi.

From this want of marking the essential difference in tuning by these syllables, and wherein the beginning and ending is not on the key, some confusion and much trouble and untunableness must arise. And indeed it cannot be imagined, that this or any other essential difference of things can be marked by the same invariable artificial signs, if they be not exactly accommodated to the nature of things. An invention that fails in this, however ingenious it may be in speculation, not being a just representation of nature, doth not merit the name of art.

For instance, if you tune eight notes, whose key hath a sharp 3d beginning on the 5th, your seventh note, which is the 4th of the key, and therefore a whole tone from the succeeding note, will sound like the flat 7th. Again, if you begin to tune on the 2d, your 3d, which is the 4th of the key, is flat; and the sound in this succession will appear as if you were tuning in a flat key.

And again, if you tune from the 6th, the deception of a flat 3d is the same as in the last case.

Secondly, if you tune 8 notes whose key hath a flat 3d, and begin on the 7th, your 3d, which is the 2d of the key, is sharp, and your tuning will be as if in a sharp key.

The same deception will appear if you begin to tune on the 3d or 6th.

In a word, whatever other interval you begin on, to tune either with flat or sharp 3d except the key, some semitones will be out of their places: This is rendering what is at first sight attended with some difficulty, more perplexed and obscure.

The ear, the judge of sounds, is deceived, and the judgment misled.

But on the other hand, the ear will naturally and easily distinguish the flat and sharp key, when the key and its 3d are ascertained by beginning and ending on the key.

But otherwise, and where these marks are promiscuously used, the difference of tune, or infallible sign, will appear neither to the ear nor understanding.

We shall end these remarks with one general observation; which is, that by assigning the place of mi to the greater 7th or 2d, in order to find out the key, is resolving one difficulty by a greater, and requiring to do a thing without any means of information offered to compass it.

For as it is true that when the greater 7th or 2d is known, the key is known also, and again, the key being given, you have consequently the 7th or 2d; yet to do either of these, without some intermediate helps, is taking for known the thing sought, which is directly contrary to reason.

Proceed we now to our method of singing by note.

The first principle of singing, is the finding the places of the two semitones in the octave, in any given key.

This

This hath been pointed out in general, in the theory, where are shewn the places of the semitones in the sharp key to be the 4th and 8th, and in the flat key the 3d and 6th.

But the particular names of the notes, on which the semitones fall in any key whatsoever, and which it is evident must depend on the name of the key, are demonstrated, and examples given, in the practice, under the article of Transposition.

We shall therefore transfer only the examples into this place, in a concise order, which will fully answer our inquiry into the names and places of the semitones.

The nine sharp keys. No. 106.

The seven flat keys. No. 107.

By these examples the particular names of all the semitones are known at sight; as they depend on the name of the key.

Therefore in the example of the sharp keys; the first key being C, the semitones are F and C.

The second G; the semitones C and G.

The third D; the semitones G and D, the 4th and 8th of each respectively.

In the example of the flat keys; the first being A, the semitones are C and F,

The second D; the semitones are F and B flat.

The third G; the semitones B flat and E flat. And so on, the 3ds and 6ths respectively.

To apply this to the purpose of tuning the notes by the voice: At sight of the sharps or flats prefixed to the tune to be sung, and looking at the key-note, you have of course the places of the semitones, by referring these to the original in the examples set above.

Having thus discovered the difference of tune, you are at the same time determined whether you are to tune the notes of the octave with a flat or sharp 3d.

This tuning of the eight notes, tones and semitones, in their due order, is the first step or principle of tuning all other intervals, or of singing by note.

It will most readily be learned by imitating another voice, or following the notes of an instrument; this is the only case wherein there is need of any foreign assistance to singing by note.

The instrument we would recommend for this purpose is the organ or harpsichord; as the 4 or 5 semitones, which ascertain the flat or sharp 3d, succeeding each other, being visible on the keys of that instrument in any part, the learner can in this case assist himself, by striking the notes of the octave in either flat or sharp key, on any part of the instrument which will best suit the pitch of his voice, and distinctly repeating them by turns, until his ear is become a perfect judge of the difference of the flat and sharp 3d, as well descending as ascending, and his voice perfect in tuning both.

As musical sounds will be best expressed in tuning by articulate ones; we shall, to answer this convenience, take the four syllables already in use.

As we shall apply them to another purpose than they serve at present; so the order or manner we shall dispose them in, will be altogether different from that.

In tuning, then, the notes of the octave with the instru-

ment, let the syllables be expressed with the notes, in the order of the following examples.

In G sharp. No. 108.

Now, since the flats or sharps adjusting the semitones of any sharp key are exactly the same which belong to the flat key respectively on the 6th, as we have said before in comparing the examples of flat and sharp keys in transposition; therefore the eight notes ascending in a flat key will have the syllables annexed to each, as in the following example on the 6th, without disturbing or departing from the order of the sharp.

In E flat. No. 109.

The semitones and the tones below them being distinguished by the syllables fa and mi, in their respective places in both keys, for descending as well as ascending notes, is the sole use we intend by these syllables; the tuning of the notes, which is to be learned by the instrument, being entirely independent of them.

For tuning the descending notes then, there need no other examples than the two above written; for reading the same backwards will serve this purpose.

When the ear becomes well acquainted with tuning the notes of the octave by the instrument, it will then be proper to sing the same looking on the notes written on the book; and this should be done in every example of both keys. And let it be remembered, that tuning the notes thus in the natural order, should be to a beginner the prelude to singing any song proposed.

The next step will be, before the learner attempts to sing any part of a song, to tune by the notes the greater intervals, both concord and discord.

The general rule for which is, Tune all the notes of the interval in the natural order, ascending if the interval ascend, and descending if the interval descend. Then immediately tune both notes of the interval, beginning with the concords.

Thus. No. 110.

Concords in succession.

The discords are. No. 111.

The semitone being the distance between the 3d and 4th, is already known by tuning the notes of this interval.

Note, The name of every greater 7th introduced by a sharp prefixed, is mi.

Next tune the concords of the thirds in succession. In this manner. No. 112.

The 4ths and 5ths being all perfect and like, except one of each, need no repetition.

The 6ths in succession are tuned thus. No. 113.

Lastly, mix the discords and concords as they stand in the natural order; than which nothing will better confirm the just tuning of the intervals, when these rules are to be applied to future practice.

In this manner. No. 114.

This line may be tuned various ways; as, secondly, beginning still on the left hand, tune the 3d and 2d notes, reading backwards; and so on, each two under the slur.

Again, beginning on the right hand, tune the uppermost note and second downwards; then the first and third; and

fo on, still missing one, and omitting constantly the G, or key not below.

And lastly, beginning still on the right hand, tune the second and first, the third and first, the fourth and first, and so on, omitting the G or key note constantly.

The practice of tuning the notes descending of all these examples, is by reading the same backwards.

The tuning the greater intervals in the flat key depending in like manner on tuning the eight notes in succession, according to that series; it is unnecessary to set examples of the same.

The same method of practice equally serving this key, except that the syllables annexed to this key must be repeated, as in the proper example 109.

As in this example of the intervals of the 3d, 6th, and 7th, wherein this key differs from the sharp. No. 115.

The general rule of tuning the intermediate notes of each interval first likewise taking place here.

In order to establish these rules in the memory, and render them of immediate service to the practitioner, especial notice must be taken of the flat and sharp thirds, as also of the flat and sharp sixths, in what places they stand, or how they succeed each other in the order of the key.

The not attending to these differences being the only obstacle that can stand in the way of singing at sight, see them set down at large in the theory, and in the examples of this chapter, No. 112, 113.

When these are well recorded in the memory, together with the sharp 4th or flat 5th, the art of singing by note will not appear so mysterious. This knowledge of the intervals at sight will render the syllables of little or no use, as hath been observed, and especially if words be set to the airs you intend to practice; which we would advise.

When the interval of each note is known at sight by constant practice, and the sound of every interval become familiar to the ear, and thereby distinguished immediately upon hearing the same, the learner may make an essay to sing by note some plain song; which is no more than tuning the same intervals, with which he is supposed to be well acquainted in the foregoing lessons.

For as to any other article of knowledge requisite to the performance of the song; as the time of the movement, and lengths of the notes, and the like; if the practitioner hath not been acquainted with them by practice on some instrument beforehand, the principles of them have been delivered in few words in the introduction to this essay.

But besides that this is not the place for speaking of these matters, so neither is there occasion for this knowledge in the very beginning, in strictness of speaking; it being advisable for a beginner to study the tuning the intervals of the song, without respect to any other affection of the sounds; and when he is master of this, to add the practice of the lengths of the notes, as a second consideration.

We shall here set the notes of a plain song, in order to make such application of the rules as may be an in-

tro-duction towards the further execution of them. No. 116.

First, find out the key, by looking at the last or key note; then see whether it hath a flat or sharp 3d.

The key of this example being G, with one sharp prefixed, is a sharp key; being the second instance in the examples of the nine sharp keys.

Therefore tune the notes of the octave ascending, and descending, in a sharp 3d. Immediately after tune the concords in succession. After that, tune the concords of the 3ds, ascending and descending. This will be prelude enough for fixing your attention and ear to the 3ds of the key, and for pitching your voice. Having repeated this two or three times, begin the song in the same pitch or key wherein you sung the prelude. For nothing contributes more to singing in tune, than frequent repetition of notes in one key. Therefore, if your voice be rightly pitched in the prelude, seek not to change it in the song.

The two first notes in the example are Fa, Mi: which interval, it is presumed, you can tune at sight. If otherwise, you must have recourse to the general rule, and tune the intermediate note of that interval ascending, thus, Fa, sol, mi; immediately repeating the interval you want to sound, thus, Fa, Mi.

The next note is the 2d, or Sol, which may be tuned from Mi, the last note, by descending; or from the key, as it hath an equal reference to both. We have laid before you this choice in consideration of your first attempt. But when from experience you are become more perfect in tuning the intervals, the most approved way will be; to make the last note you sung relative to the succeeding one, whose interval you are to tune. Whereby your singing an air will be no other than tuning the intervals as they succeed each other in the movement of the song; which you practised often before in the natural order, and with which you are supposed to be well acquainted.

The fourth note in the example being Sol, and a 4th to the last note you sung, you will now tune a perfect 4th; not considering this note in relation to the key, to which it is a 5th; but in relation to the last sounded note Sol, to which it is a 4th.

This is the method you will pursue in every interval after some improvement gained by practice. Notwithstanding, it will be convenient sometimes to have recourse to the key, by sounding it, and taking the interval from the same; whereby you will sing better in tune by keeping to the pitch or key you began in; particularly if the interval from the last note be a great one, or discord, or lie near the key, above or below.

To sum up all; every new note introduced; or not belonging to the harmony of the key, bearing the proportion of some concord or discord, to the preceding note or to the key, will come within the rules laid down, and therefore needs no repetition.

On the principles of the theory and practice of music, we shall now demonstrate the art of transposing with the voice, or singing in any cliff at sight, wherewith it may happen a person is not acquainted; and this from the knowledge of singing in any other cliff.

**N<sup>1</sup>**

major minor femi- tone major minor major femi- tone minor major femi- tone minor major

3

Sharp Flat

4<sup>th</sup> #3<sup>d</sup> b3<sup>d</sup> #6<sup>th</sup> b6<sup>th</sup>

Semitones

4

5

6

7

b d #d b e #e f f# g# a# b# c#

1 2 3 4 5 6 7 8 9 10 11 12 13

8

9

Key tone femitone Key tone femitone Key tone femitone

10

Key 2<sup>d</sup> 3<sup>d</sup> 4<sup>th</sup> 5<sup>th</sup> 6<sup>th</sup> 7<sup>th</sup> 8<sup>th</sup>

11

12

5<sup>th</sup> 8<sup>th</sup> #3<sup>d</sup> b3<sup>d</sup> b3<sup>d</sup> #3<sup>d</sup> #3<sup>d</sup> b3<sup>d</sup> b3<sup>d</sup>

13

14

4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> #4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> b5<sup>th</sup>

15

16

#6<sup>th</sup> #6<sup>th</sup> b6<sup>th</sup> #6<sup>th</sup> #6<sup>th</sup> b6<sup>th</sup> b6<sup>th</sup> b3<sup>d</sup> b3<sup>d</sup> #3<sup>d</sup> b3<sup>d</sup> b3<sup>d</sup> b3<sup>d</sup> #3<sup>d</sup> #3<sup>d</sup>

17

4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> 4<sup>th</sup> #4<sup>th</sup> 4<sup>th</sup>

18

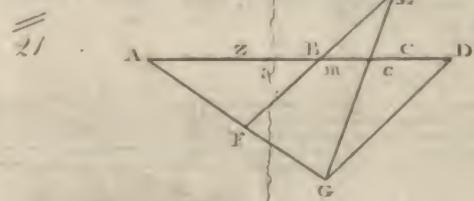
5<sup>th</sup> b5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup> 5<sup>th</sup>

19

b6<sup>th</sup> b6<sup>th</sup> =6<sup>th</sup> =6<sup>th</sup> b6<sup>th</sup> #6<sup>th</sup> =6<sup>th</sup>

20

4<sup>th</sup> 5<sup>th</sup> b5<sup>th</sup> 6<sup>th</sup> 8<sup>th</sup> D 15<sup>th</sup>



22  
 A Seimbrieve ○ whose Time is as long as 1, 2, 3, 4,  
 or 2 Minims

4 Crotchets

8 Quavers

16 Semiquavers

32 Demise-  
 miquavers

*J. B. ...*

Plate CNIX.

34

or thus

First system of musical notation. The treble clef staff begins with measure 34, marked with a double bar line and a repeat sign. The bass clef staff contains figured bass notation: 8 3 5 3 8 6 5 8. A double bar line separates measure 34 from measure 35, which begins with a repeat sign and the figures 8 6 6 6 6 5 8.

34

or thus

35

Second system of musical notation. The treble clef staff begins with measure 34, marked with a double bar line and a repeat sign. The bass clef staff contains figured bass notation: 8 7 8 6 1 6 3 8. A double bar line separates measure 34 from measure 35, which begins with a repeat sign and the figures 3 5 8 6 8 3 3 3.

35

or thus

35

or thus

Third system of musical notation. The treble clef staff begins with measure 35, marked with a double bar line and a repeat sign. The bass clef staff contains figured bass notation: 8 5 8 5 5 8 5 8. A double bar line separates measure 35 from measure 36, which begins with a repeat sign and the figures 8 6 5 6 8 5 5.

35

Fourth system of musical notation. The treble clef staff begins with measure 35, marked with a double bar line and a repeat sign. The bass clef staff contains figured bass notation: 8 6 3 5 6 6 5 8. A double bar line separates measure 35 from measure 36, which begins with a repeat sign and the figures 8 6 3 5 6 6 5 8.

36

Fifth system of musical notation. The treble clef staff begins with measure 36, marked with a double bar line and a repeat sign. The bass clef staff contains figured bass notation: 8 6 3 5 6 6 5 8.

24

Treble Cliff

Musical staff for Treble Cliff, measures 24-25. The staff is in G major (one sharp) and 2/4 time. It contains a sequence of notes: G, A, B, C, D, E, F, G, A, B, C, D, E, F, G, A, B, C. The notes are written as half notes on a five-line staff.

Tenor Cliff

Musical staff for Tenor Cliff, measures 24-25. The staff is in G major (one sharp) and 2/4 time. It contains a sequence of notes: D, C, B, A, G, F, E, D, C, B, A, G, F, E, D, C, B, A. The notes are written as half notes on a five-line staff.

Bass Cliff

Musical staff for Bass Cliff, measures 24-25. The staff is in G major (one sharp) and 2/4 time. It contains a sequence of notes: B, A, G, F, E, D, C, B, A, G, F, E, D, C, B, A, G, F. The notes are written as half notes on a five-line staff.

25

26

27

28

29

30

31

Piano accompaniment for measures 25-31. The right hand (treble clef) contains single notes corresponding to the measures above. The left hand (bass clef) contains chords and single notes, with fingerings indicated by numbers 1-5. The key signature is G major (one sharp).

32

32

or Unas

Piano accompaniment for measures 32-33. The right hand (treble clef) contains single notes. The left hand (bass clef) contains chords and single notes, with fingerings indicated by numbers 1-5. The key signature is G major (one sharp).

32

or Unas

33

Piano accompaniment for measures 32-33. The right hand (treble clef) contains single notes. The left hand (bass clef) contains chords and single notes, with fingerings indicated by numbers 1-5. The key signature is G major (one sharp).

Plate. CXXI.

37

K K 3 2 K 4 3 K

3 6 5 4 3 8 5 8

38

K K 4 3 K 1 2 K 3 K

3 6 6 5 3 3 8 4 3 8

39

K K 3 K 3 3 b7 3 b7 3 4 <sup>or</sup> 3 K 3 K

Grave

3 3 3 8 6 6 5 8 3 8 5 4 3 3 8

40 Andante

3 K 3 K K K 3 K b7 3 K 3 K 4

3 4 3 8 8 5 6 6 8 5 3 3 6 8 6

3 b7 K K K K 3 K

6 6 3 3 6 5 8



or thus Plate. CXXIII

43

K 3 K 4 K 1 8 K 44 K b7 3 4 K 4 5 K

8 3 8 6 3 8 5 8      8 5 8 6 8 3 3 8

43

3 3 6 5 3 8 5 3      3 5 3 3 4 8 5 8

43

45

45 KK3 K 3 3b 3b7 3 5 K 3 K 5 K 46 KK K K b6 b7 3 K 5 K 4 K 5

8 6 5 8      6 6 5 8 5 4 3 8 5 4 3 8

45

3 3 3 8 3 4 5 8 4 6 5 3 3 6 5 8

45

47

K K 3 or b7 3 K K 5 K 47 K 5 K 5 K 4 K 4 3 4 3 3 b6 3b7 3

3 3 3 8 3 4 5 8 4 6 5 3 3 6 5 8

47

47

Plate. CXXIII.

47 3 4 3 3 3 K K 3 K 48K 3 K 4 K 4 5 6

5 6 8 5 8 1 5 3  
3 3 3 3 6 0 0 5

49 K 3 4 K 4 K 5 K Grave 50 K 2 3 K 3 3 7 3 4 3 5 K 5 K 5 B

6 3 0 3 4 5 5 0  
3 5 6 0 5 4 5 3  
5 0 5 6 3 0 3 3  
8 6 5 7 6 6 5 8 4 8 5 0 4 1 5  
5 6 7 8 5 4 7 8 6 5 7 5 6 5 0  
5 5 5 5 3 6 8 5 8 5 6 5 7 5 3

Plate. CXXV

♩

KK 2 K 6 7 3 K 5 K 4 K 3 KK K 3 K

Andante

8 7 2 6 2 5 4 3 6 4 6 3 5 3 6 5 8

3 6 5 5 3 8 3 2 3 3 4 8 3 8 1 5 3

5 2 3 6 5 8 5 8 2 3 8 4 5 3 5 5 5

♩

52

55

54 Grave

Plate. C XXVI. 55 Andante

First staff of music, treble clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a common time signature (C) and a key signature change to one flat (Bb).

Second staff of music, treble clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a common time signature (C) and a key signature change to one flat (Bb).

Third staff of music, treble clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a common time signature (C) and a key signature change to one flat (Bb).

Fourth staff of music, bass clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a common time signature (C) and a key signature change to one flat (Bb).

Fifth staff of music, bass clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a common time signature (C) and a key signature change to one flat (Bb).

Sixth staff of music, treble clef, 3/2 time signature. It begins with a key signature of one flat (Bb) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#) and the number 56.

Seventh staff of music, treble clef, 3/2 time signature. It begins with a key signature of one flat (Bb) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#).

Eighth staff of music, treble clef, 3/2 time signature. It begins with a key signature of one flat (Bb) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#).

Ninth staff of music, bass clef, 3/2 time signature. It begins with a key signature of one flat (Bb) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#).

Tenth staff of music, bass clef, 3/2 time signature. It begins with a key signature of one flat (Bb) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#).

Eleventh staff of music, bass clef, 3/2 time signature. It begins with a key signature of one sharp (F#) and contains a series of half notes. A double bar line is followed by a key signature change to one sharp (F#).

The first system of music consists of six staves. The first staff is in treble clef with a key signature of one sharp (F#) and a 3/2 time signature. It contains a melodic line of half notes. The second staff is also in treble clef with a key signature of one sharp and a 3/2 time signature, containing a similar melodic line. The third staff is in treble clef with a key signature of one sharp and a 3/2 time signature, containing a similar melodic line. The fourth staff is in treble clef with a key signature of one sharp and a 3/2 time signature, containing a similar melodic line. The fifth staff is in bass clef with a key signature of one sharp and a 3/2 time signature, containing a similar melodic line. The sixth staff is in bass clef with a key signature of one sharp and a 3/2 time signature, containing a similar melodic line. A double bar line is present after the first measure of each staff.

30. Andante

The second system of music consists of six staves. The first staff is in treble clef with a key signature of one sharp (F#) and a common time signature (C). It contains a melodic line of half notes. The second staff is in treble clef with a key signature of one sharp and a common time signature, containing a similar melodic line. The third staff is in treble clef with a key signature of one sharp and a common time signature, containing a similar melodic line. The fourth staff is in treble clef with a key signature of one sharp and a common time signature, containing a similar melodic line. The fifth staff is in bass clef with a key signature of one sharp and a common time signature, containing a similar melodic line. The sixth staff is in bass clef with a key signature of one sharp and a common time signature, containing a similar melodic line. A double bar line is present at the end of the system.



Handwritten musical score for a piece titled "Grave" and "Andante". The score consists of 15 staves. The first 10 staves are in 3/2 time and feature a series of chords and single notes. The 11th staff begins a new section with a treble clef, a key signature of one flat, and a tempo marking of "65". This section includes a complex rhythmic pattern with sixteenth notes and triplets, marked with "66" and "67". The final two staves return to a simpler chordal texture.

System 1: Five staves of music. The top staff is in treble clef with a key signature of one sharp (F#). The bottom staff is in bass clef with a key signature of one sharp (F#). The music consists of a melodic line in the upper staves and a bass line in the lower staves.

System 2: Five staves of music. It begins with a measure marked "68". The top staff is in treble clef with a key signature of one sharp (F#). The bottom staff is in bass clef with a key signature of one sharp (F#). The music continues with a melodic line and a bass line.

System 3: Five staves of music. It begins with a measure marked "69". The top staff is in treble clef with a key signature of one sharp (F#). The bottom staff is in bass clef with a key signature of one sharp (F#). The music continues with a melodic line and a bass line.

System 4: Five staves of music. It begins with a measure marked "70". The top staff is in treble clef with a key signature of one sharp (F#). The bottom staff is in bass clef with a key signature of one sharp (F#). The tempo marking "Andante" is present. The music continues with a melodic line and a bass line.

System 5: Five staves of music. The top staff is in treble clef with a key signature of one sharp (F#). The bottom staff is in bass clef with a key signature of one sharp (F#). The music continues with a melodic line and a bass line.



90 91 92 93

94 95 96 97

98

99

Semi: Er

are proportional

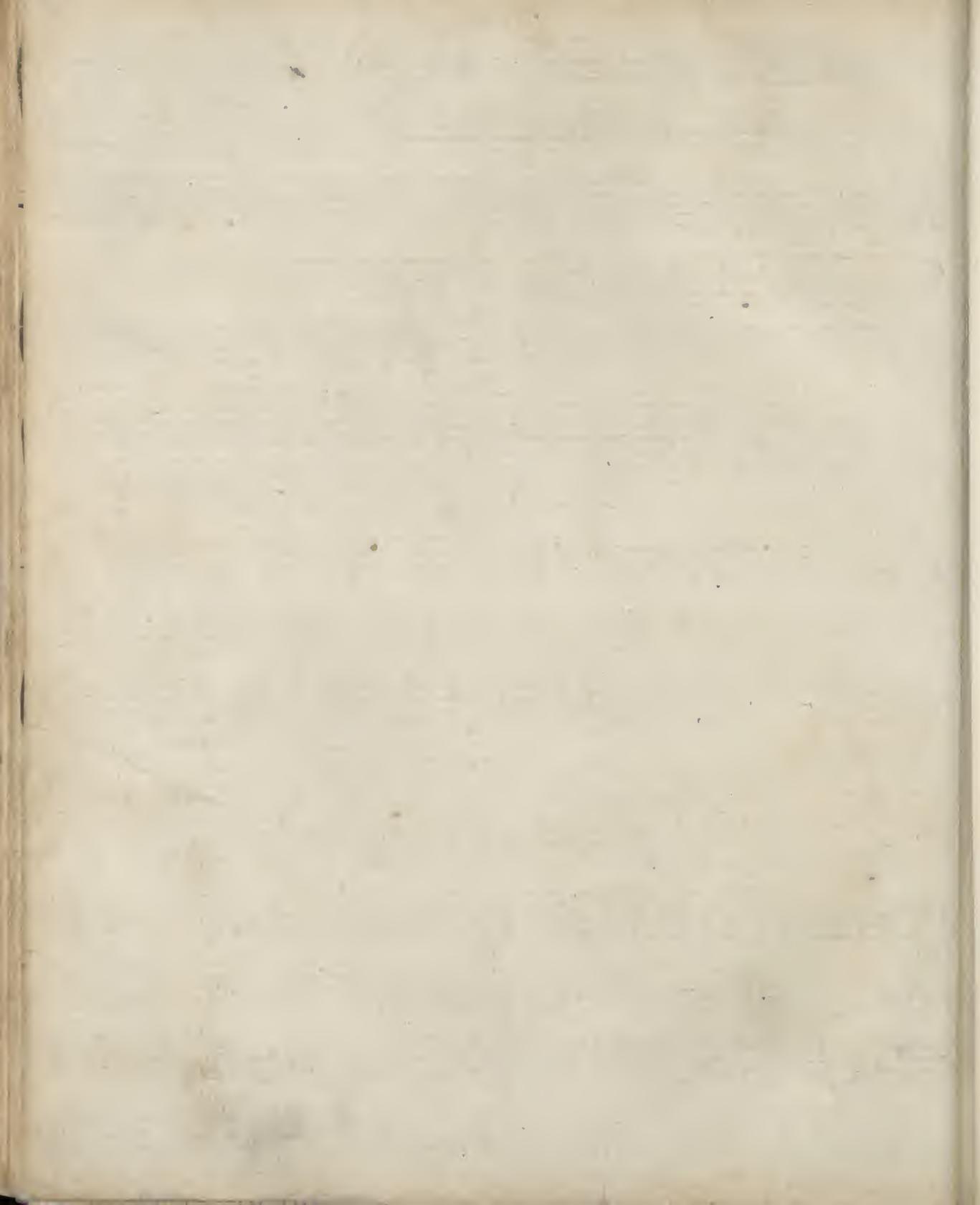
100 101

102 103

104

3<sup>d</sup> 6<sup>th</sup>





**THEOREM.** The intervals of the notes of all sharp keys and flat keys respectively, are proportional. Therefore, the finging at sight in an unknown cliff will be by transposing out of the given cliff, into that you are acquainted with.

This is done by naming the key in the cliff you are to transpose into, and distinguishing whether the song hath a flat or sharp 3d, compared to the examples of the nine sharp and seven flat keys in use, knowing the name of each cliff. Now, the name of the bass cliff is F, of the tenor C, and of the treble G.

Let it be required to sing the notes in the following example in the bass cliff unknown; transposed into the treble with which you are acquainted. No. 117.

The notes in the uppermost line, in the bass cliff, are in G.

In the second line and treble cliff, they are in E.

**DEMONSTRATION.** By the rules of transposition they are the second and fifth instances in the sharp key; then they are proportional: if proportional, the semitones are preserved in their proper places: but keeping or singing the semitones in their places, is tuning the notes of the octave right; therefore this transposition from the bass cliff into the treble is singing by note right.

The same example in the tenor. No. 118.

The notes of the tenor are in F; those of the treble in E. But they are the ninth and fifth instances of sharp keys, therefore proportional; and if proportional, &c.

Again, let the treble be the unknown cliff. No. 119.

The notes of the treble are in D, of the tenor in C, they are the third and first instances of sharp keys; therefore proportional, &c.

This demonstration from proportion extends to all possible cases, and therefore makes the proposition universal.

The last example shall be in the tenor cliff, set in the usual places, and in a flat key. No. 120.

In the upper staff the key is G.

In the second, B.

In the third, D. But these keys are the third, the sixth and second instances of the seven flat keys; hence they are proportional: therefore singing them in this proportion is preserving the semitones; and therefore singing them right.

On these principles, it is apprehended, the art of singing by note is rendered intelligible, and the performance tolerably easy; and this especially by removing the difficulties which have taken their rise from the manner of delivering the precepts, and from the usage of variety of cliffs: difficulties, which are the effects, we may say, of too much art, and for this reason perhaps the more perplexing; for whatever of this kind may arise from the nature of the subject of any science, the same may by attention and study in time be surmounted, such cases lying open to every one's inquiry; it being the business of every searcher into nature to contemplate the things themselves, and to make the best use of such discoveries as offer themselves towards the further improvement of science.

## M U S

**MUSK**, a dry, light, and friable substance, of a dark blackish colour, tinged with purple; it is a kind of perfume of a very strong scent, and only agreeable when in a very small quantity, or moderated by the mixture of some other perfume. It is found in a kind of bag or tumour which grows under the belly of the moschus moschiferus. See *MOSCHUS*.

Musk is brought to us sewed up in a kind of bladders or cases of skin of the bigness of a pigeon's egg, or larger, each containing from two or three drams to an ounce of musk. These are covered with a brownish hair, and are the real capsules in which the musk is lodged while on the animal. That which is unadulterated appears in masses, of loose and friable granules, which are soft to the touch, and easily crumble between the fingers, feeling somewhat smooth and unctuous.

Musk taken inwardly produces ease from pain, quiet sleep, and a copious diaphoresis: hence it has been found of great use in spasmodic disorders, petechial, malignant, putrid fevers, the jail distemper, hiccoughs, &c. and Dr Wall observes, that it has been found useful in spasmodic disorders, given by way of clyster. The operation of musk in some respects resembles that of opium; but it does not leave behind it any stupor or languidness, which the latter often does. Musk likewise seems likely to answer in those low cases where

## M U S

sleep is much wanted, and opiates are improper. It is said to be best given in a bolus, in which form those who are most averse to perfumes may take it without inconvenience. Fifteen grains or more are now given in a dose with great success.

**MUSKET**, a fire-arm born on the shoulder, and used in war. The length of a musket is fixed at three feet eight inches from the muzzle to the pan, and it carries a ball of sixteen to the pound.

**MUSKETOON**, a kind of short thick musket, whose bore is the thirty-eighth part of its length: it carries five ounces of iron, or seven and a half of lead, with an equal quantity of powder. This is the shortest sort of blunderbusses.

**MUSLIN**, a fine sort of cotton cloth, which bears a downy knap on its surface. There are several sorts of muslins brought from the East-Indies, and more particularly from Bengal; such as doreas, betelles, mulmuls, tanjeeds, &c.

**MUSSÆNDA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel-shaped; it has two thickish stigmata; the berry is oblong, and the seeds are disposed into four series. There is but one species, a native of India.

**MUSSELBOROUGH**, a port-town of Scotland, in the shire of Lothian, six miles east of Edinburgh.

**MUSTARD**, in botany. See *SINAPI*.

**MUSTELLA**, in zoology, a genus of quadrupeds of the order of fereæ. There are six erect, sharp, distinct teeth in the upper jaw, and an equal number in the under jaw, but blunter and closer together, and two of them are situated a little farther within the mouth; and the tongue is smooth. There are 11 species, *viz.* 1. The lutris, with the hind-feet palmated, and the tail about one fourth of the length of the body. It is found in Asia and North America. 2. The lutra, or otter, has palmated feet, and a tail about one half of the length of the body. This animal is exceedingly voracious; but is fonder of fish than of flesh. He seldom quits the banks of rivers, and can remain a considerable time below water. The female comes in season in the winter, and brings forth three or four young in March. This animal is found in most countries of Europe and North America. 3. The lutreola has hairy palmated feet, and a white mouth. It is a native of Finland, and feeds upon frogs and fishes. 4. The barbata, is of a reddish colour; and the toes are not connected with a membrane. It is a native of Brazil. 5. The gulo is of a dusky red colour, and blackish on the middle of the back. It is found on the woody mountains of Lapland, Russia, and Siberia. The gulo is a very voracious animal, and devours hairs, birds, &c. He has an abominable odor; but his fur is very precious. 6. The martes, or marten, is of a blackish yellow colour, with a pale throat, and the toes are not webbed. This animal is a native of the southern parts of Europe; it frequents the woods, and feeds upon squirrels, mice, and birds. 7. The putorius, or pole-cat, has unconnected toes, is of a dirty yellow colour, with a white mouth and ears. This animal is very destructive to birds and poultry. He conceals himself during the day; but steals into barns, dove-cotes, hen houses, &c. in the night, in order to catch his prey. He is a native of most parts of Europe. 8. The furo, or ferret, has red eyes, and unconnected toes. This animal is easily tamed, and frequently employed to hunt rabbits out of their holes. The female is less than the male, and brings forth twice in the year, 5 or 6 at a litter. It is a native of Africa. 9. The zibellina has divided toes; the body is of a dusky yellow colour, with a white forehead, and an ash-coloured throat. It is found in Tartary, and the northern parts of Asia. 10. The erminea has divided toes; and the point of the tail is red. The skin of this animal is a valuable fur, and of a fine white colour. It is a native both of Europe and Asia, and particularly of the northern climates. It feeds upon mice, eggs, &c. and has a very offensive smell. 12. The nivalis has divided toes, and a white body. It is very similar to the ermine, but about one half less in size. It is found in Russia and the northern parts of Europe. See Plate CV. fig. 3. and Plate CVI. fig. 1, 2, 3, 4.

**MUTE**, in a general sense, signifies a person that cannot speak, or has not the use of speech.

**MUTE**, in grammar, a letter which yields no sound without the addition of a vowel. The simple consonants are ordinarily distinguished into mutes and liquids or semi vowels.

**MUTILATION**, the retrenching or cutting away any member of the body.

**MUTILATION**, in Scots law. See LAW, Tit. xxxiii.

**MUTULE**, in architecture, a kind of square modillion set under the cornice of the Doric order.

**MUTUUM**, or LOAN, in Scots Law. See LAW, Tit. xx. 7.

**MUZZLE** of a gun or mortar, the extremity at which the powder and ball is put in; and hence, the muzzling is the metalline circle, or moulding, that surrounds the mouth of the piece.

**MYAGRUM**, in botany, a genus of the tetrandria filiculosa class. The pod is terminated with a conical stylus, and generally contains but one seed. There are nine species, only one of which, *viz.* the fativum, or gold of pleasure, is a native of Britain.

**MYCONE**, one of the islands of the Archipelago, about twenty-five miles in circumference, situated in E long. 25°. 6', N. lat. 37°.

**MYLOGLOSSUM**, in anatomy. See ANATOMY, p. 304.

**MYLOHYOIDÆUS**, in anatomy. See ANATOMY, p. 304.

**MYOLOGY**, that part of anatomy which treats of the muscles of the human body. See ANATOMY, Part II.

**MYOPIA**, short-sightedness, a species of vision, wherein objects are seen distinctly only at small distances. See OPTICS.

**MYOSOTIS**, in botany, a genus of the pentandria monogynia class. The corollary consists of 5 emarginated segments. There are four species, only one of which, *viz.* the scorpioides, or mouse-ear scorpiograss, is a native of Britain.

**MYOSURUS**, in botany, a genus of the pentandria polygynia class. The calix consists of five leaves connected at the base; it has five subululated, petal-shaped nectaria; and the seeds are numerous. There is but one species, *viz.* the minimus, or mouse-tail, a native of Britain.

**MYRIAD**, a term sometimes used to denote ten thousand.

**MYRICA**, in botany, a genus of the diœcia tetrandria class. The amentum of the male has a lunulated scale; the corolla is wanting both in the male and female; the female has two styli; and the berry contains only one seed. There are five species, none of them natives of Britain.

**MYRIOPHYLLUM**, in botany, a genus of the monœcia polyandria class. The calix of both male and female consists of four leaves, and none of them have any corolla: the male has eight stamina, and the female four pistilla; and there are four naked seeds. There are two species, both natives of Britain, *viz.* the spicatum, or spiked water-millfoil; and the verticillatum, or verticillated mill-foil.

**MYRMECOPHAGA**, in zoology, a genus of quadrupeds belonging to the order of bruta; the characters of which are these: There are no teeth in the mouth; the tongue is long and cylindrical; the head terminates in a long snout or muzzle; and the body is covered with

with pretty long hair. There are 4 species, viz. 1. The didactyla, or white American coat of Seba, has two toes on the fore-feet and four on the hind feet. This animal is about 7 inches long; the head is two inches in length; the snout is not so long as that of the other species; the tail is about an inch longer than the body, and covered with pretty long hair; the legs are not made for walking, but jumping. He climbs trees, and hangs on the branches by the extremity of his tail. In this situation he thrusts his long tongue in the holes or fissures of trees, and brings it out covered with ants or other insects. He can live long without nourishment of any kind, sleeps generally in the day, and searches for food in the night. 2. The tridactyla, tamandua-guaca, or tamaroi, has three toes on the fore-feet, and five on the hind-feet, and long hair on the tail. This animal is about four feet long, and the head and snout about fifteen inches: It is a native of the East Indies, and feeds upon ants, &c. in the same manner as the didactyla. See Plate CXVI. fig. 4.—3. The jubata, has four toes on the forefeet and five on the hind ones, and a very hairy tail. This animal resembles the tridactyla, and is found at the Cape of Good Hope. 4. The tetradactyla, has four toes on the fore feet and five on the hind, with a tail naked at the extremity. It is a native of south America.

**MYROBALANS**, a kind of medicinal fruit brought from the Indies, of which there are five kinds: 1. The citrine, of a yellowish-red, hard, oblong, and the size of an olive: 2. The black, or Indian myrobalan, of the bigness of an acorn, wrinkled, and without a stone: 3. Chebulic myrobalans, which are of the size of a date, pointed at the end, and of a yellowish brown. 4. Emblic, which are round, rough, the size of a gall, and a dark-brown: and, 5. Belleric, which are hard, round, of the size of an ordinary prune, less angular than the rest, and yellow. Each of these kinds are slightly purgative and astringent; but Quincy observes, that the best of them are not worth regarding, since they rather clog than assist any composition.

**MYRRH**, a vegetable production of the gum or resin kind, issuing by incision, and sometimes spontaneously, from the trunk and larger branches of a tree growing in Egypt, Arabia, and Abyssinia. The incisions are made twice a-year, and the myrrh oozing out is received on rush-mats dispersed underneath.

Myrrh is sent over to us in loose granules of various sizes, from that of a pepper-corn, to the bigness of a walnut. The generality of them, however, are from the size of a pea, to a little more than that of a horse-bean: these are sometimes roundish, but often irregularly long and contorted. The colour of myrrh is a reddish-brown, with more or less of an admixture of yellow, and in the purest pieces it is somewhat transparent. Its taste is bitter and acrid, with a peculiar aromatic flavour, but very nauseous: but its smell, though strong, is not disagreeable. It is to be chosen in clear pieces, light, friable, and of the bitterest taste. Myrrh is of great use in medicine; it powerfully resolves and attenuates thick and viscid blood, and concrets bile, and glutinous humours, and is good in ob-

structions of the menes, and in infarctions of the viscera.

**MYRSINE**, in botany, a genus of the pentandria monogynia class. The corolla consists of five segments; and the berry has five cells and five seeds. There is but one species, a native of Ethiopia.

**MYRTIFORM**, in anatomy, an appellation given to several parts, from their resembling myrtle-berries.

**MYRTLE**, in botany. See **MYRTUS**.

**MYRTUS**, the **MYRTLE**, in botany, a genus of the icosaandria monogynia class. The calix consists of five segments, and the corolla of five petals; and the berry contains two or three seeds. There are 13 species, none of them natives of Britain.

**MYRSIA**, the ancient name of a province in Asia, being the north-west part of Natolia or Asia Minor.

**MYTHOLOGY**. The word *mythology* is a Greek compound, that signifies a discourse on fables; and comprehends, in a collective sense, all the fabulous and poetic history of pagan antiquity. It follows therefore, that this science teaches the history of the gods, demi-gods, and fabulous heroes of antiquity; the theology of the pagans, the principles of their religion, their mysteries, metamorphoses, oracles, &c. By this definition, it appears sufficiently what are the objects of which we are to treat in this article.

If we well consider the matter, we shall find, that there were, in pagan antiquity, three different religions. First, That of the philosophers, who treated metaphysically of the nature, the attributes, and of the works of the Supreme Being. They endeavoured to discover the true God, and the manner in which he ought to be worshipped. It is not wonderful, that these men of exalted genius should in some degree ridicule, in their works, the two other positive religions, and those gods on whom they were founded; at the same time that they outwardly professed the established religion, in order to preserve the peace of society, and to avoid the persecutions of the legislature, and the insults of the populace. For in fact, was it possible for them to believe the pagan fables? Must they not foresee, that their religion would one day give place to another, while their own works would pass with their names to the latest posterity? And could they suffer the thought, that their reputation would be tarnished in the eyes of that posterity, by having it imagined they believed such idle tales as were broached by the priests of their times? Could Plato, Socrates, Seneca, and Cicero, be unconcerned for their fame among future generations, and future philosophers? And what should we at this day have said of those great men, had they been so political, or hypocritical, as to have entirely concealed their sentiments with regard to these matters?

The second religion was that of paganism, which was the established religion of all the ancient nations except the Jews. This was the doctrine that was taught by the priests, and protected by the sovereigns. Its dogmas were demonstratively false, but not always so absurd as may at first appear, especially if we annex to the divinities, and to the religious ceremonies of the pagans, a sense that is frequently mystic, and always allegoric; if we remember,

that the first heathens deified those great men to whom the rest of mankind were indebted for any signal benefits, as Jupiter, Apollo, Ceres, Bacchus, Hercules, Æsculapius, &c. in order to induce others, as well of the present as future ages, to reverence and to imitate them. Would not an ancient pagan, if he were to return upon the earth, have specious arguments, at least, to support his religion, when he saw weak mortals beatify or canonize, merely by their own authority, other weak mortals (frequently mere pedants,) and place them in heaven, without the permission or approbation of the Supreme Being? Happy is it for mankind, when at different times sagacious pontiffs purge the calendar, and the brains of the people, from a herd of pretended saints, and prevent them, at least after their death, from doing injury to society, by interrupting the industry of the laborious inhabitants with keeping their festivals.

The third religion was idolatry, or the religion of the populace. For the common people, born to be deceived in every thing, confounding in their imaginations the statues of the gods, the idols of their divinities, the emblems of their virtues and of religious worship, with the gods, divinities, virtues and worship themselves, adored these images, and proceeded to extravagancies the most ridiculous, and frequently most criminal, in their ceremonies, feasts, libations, sacrifices, &c. It is to be feared, that, as long as there are upon the earth men of our limited capacities, this triple religion will constantly subsist under different forms; and we are much deceived, if it may not be found under the empire of Christianity itself, notwithstanding the purity of its doctrine. It will be easily conceived, that it is not of the religion of philosophers, nor that of the populace, of which we are to treat in this article of Mythology; but of that which subsisted under the authority of the magistracy and the priesthood, and consequently of paganism in general.

As far as we are able to judge by all the ancient authors we have read, the pagans adored the sovereign Lord of the universe under the name of *Fate* or *Destiny*, which we must not confound with *Fortune*, who was regarded as a subaltern divinity. Jupiter himself, all the gods, every animated being, the heavens, the earth, the whole frame of nature, was subservient to *Destiny*, and nothing could reverse its decrees. This divinity was so highly adorable, as to be above all rank; and was regarded as too supreme to be represented under any sensible image or statue, or to have any temple erected for its worship. We do not remember to have read, that any sacrifice was ever offered to this *Destiny*, or that any temple or city was ever dedicated to its name. We are almost inclined to think, that the pagans were sensible, that the temple and the worship of the God of gods ought to be in the heart of man. Mention is made, indeed, of a temple that was dedicated to the Unknown God, but we are ignorant whether or not *Destiny* were thereby meant. We must not confound this *Destiny*, moreover, with the goddesses of chance, of which there are some antique statues that represent her in a recumbent posture, and playing with little bones; for this was nothing more than an invention of some statuary.

After this general and philosophical idea of the Su-

preme Being, comes the positive religion of the pagans. This was entirely founded on fable, which took its rise either from ancient traditions, or historical events, altered or augmented by the imaginations of the poets, by superstition, or by the credulity of the people; or else it consisted of allegoric or moral fictions. A crowd of writers, and among the rest *Noël le Comte*, (*Natalis Comes*;) the abbots *Banner* and *Pluche*, &c. have made many researches into the origin of fable: and they think they have discovered its source, 1. in the vanity of mankind; 2. in the want of letters and characters; 3. in the delusive eloquence of orators; 4. in the relations of travellers; 5. in the fictions of poets, painters, statuary, and dramatic writers; 6. in the diversity and uniformity of names; 7. in the ignorance of true philosophy; 8. in the foundation of colonies, and the invention of arts; 9. in the desire of having gods for our ancestors; 10. in the imperfect or false interpretation of the holy scriptures; 11. in the ignorance of ancient history; 12. in a like ignorance of chronology; 13. in that of foreign languages; 14. in the translation of the religion of the Egyptians and Phœnicians into Greece; 15. in the ignorance of geography; and, 16. in the belief that the first people had of the intercourse of gods with men. It is certain, that all these matters taken together are sufficient to produce many thousands of fables; are more than sufficient to enable us to deceive ourselves and others, and to give rise to infinite reveries. But we should take care how we draw from these sources demonstrations that might be used, by infidels, as arguments to overthrow the history of the Jews; a people the most stupid, most credulous, and ostentatious of all others. In the mean time, the pagan philosophers themselves asserted, that it was a god who invented the fable: so much they were convinced of its ingenuity, and of its strong tendency to instruct mankind in their duty.

Mythology therefore, when properly treated, begins with making learned researches into the real origin of fable, of paganism, and of that idolatry which was its consequence. It recurs for this purpose even to the beginning of the world: and after finding that *Laban*, the father-in-law of the patriarch *Jacob*, was a maker of idols; and that he had his little images, or household-gods, which he formed of baked earth, and which shews that idolatry existed in the greatest antiquity; it then explains *cosmogony*, and *theogony*, or the belief that the first inhabitants of the earth entertained of the creation of the universe, and what the pagan theology taught of the genealogy of their false gods. It begins with the tradition of the Chaldeans, a people so ancient, that *Nimrod* was their first king; but at the same time so credulous and superstitious, that we may regard them as the authors of all those fables, and the propagators of all those visions, that have since blinded human reason. According to this tradition, a monster named *Oannes*, or *Oes*, half fish and half man, sprang from the sea, before the chaos was completely dispersed, and gave laws to the Chaldeans. A woman called *Omorka*, reigned over all the earth. *Bel* cut her in two, and made of one moiety the heavens, and of the other the earth. They likewise invented the two primitive beings, of which the good one, who was named *Orafnasdes*, had the direction

tion of heaven; and the other, called *Arimanius*, that of hell.

The science of mythology then teaches the theogony of the Phœnicians; concerning whom it draws great lights from Sanchoniathon, a priest of Beryte, who lived before the Trojan wars, more than four hundred years before Hesiod and Homer, and of whom Eusebius has preserved considerable fragments. From thence it passes to the theogony of the Egyptians; of whom *Thot* or *Thaut*, the founder of that nation, was likewise, they say, their first historian; that Sanchoniathon even copied from him; and of whom we find many relations in the Greek historians, especially in Herodotus, Diodorus Siculus, and in Eusebius of Cæsarea. It then examines the theogony of the Atlantides, who dwelt on the western part of Africa, and of whom Diodorus alone has preserved any account. From thence it proceeds to the theogony of the Greeks, which is far better known to us, as we find accounts of it, more or less particular, in numberless Greek and Latin writers. This theogony had the same foundation as that of the Romans; the latter having only extended it, by adding to the Greek divinities certain gods or demigods, formed of their heroes, and certain symbolic and allegoric divinities, which mythology explains at the same time: and it is on this occasion that it enters into a particular explication of the cosmogony and theogony of Ovid; whose book of metamorphoses contains as copious descriptions as we could desire of the fables of the ancients: what was their belief concerning the habitations of the blessed after their death, or of the Elysian fields; as well as of their hell or tartarus; of the dog Cerberus; of the ferryman Charon; of the furies; of the four rivers, Cocytus, Lethe, Phlegethon, and Styx, which water the tartarian regions, &c. The learned have likewise made many inquires, and many ingenious discoveries; concerning the theogony of the ancient Germans, Celts, the Scythian and Hyperborean nation. In the last place, this science furnishes great lights on the theogony of the Bramins, the Troglodytes, the Indians, the Chinese, and even the Americans; all which it concludes with a regular and minute examination of the pagan theology, and particularly that of the poets.

All these matters being well digested in the minds of those who would make a regular study of pagan theology, they continue their researches into the time, the epoch and place of the real origin of paganism and idolatry; and they prove that the pagans began by adoring the heavenly bodies, the stars and planets. They next examine into the progress of idolatry: what were the temples of the pagans, their altars, their inclosures, their sacred groves, their asylums, the idols and statues of their deities; in what manner they were represented; what were their sacrifices, the victims that were offered; what were the sacred vessels, the censers and other instruments that were used in the sacrifices, libations, and other religious ceremonies: concerning the priests, priestesses, and other attendants on the service of each divinity: what were the festivals that were celebrated among the Greeks and Romans, as well as among the orientals; what the days of penitence and supplication, the feasts or the gods of Iecisternia, their invocations or incantations, and exorcisms,

the religious ceremonies observed at laying the foundations of cities, &c.

Divination, or the prediction of future events, a weakness that has at all times possessed the human mind, forms also an important article of pagan theology. It is therefore in this place, that mythology considers the nature of *Oracles*; and in particular, 1. The oracle of Dodono, the most ancient of Greece; 2. That of Jupiter, Hammon or Ammon, in Libya; 3. That of Jupiter Philus; 4. That of Apollo, both of Heliopolis; 5. That of Apollo of Delphos; 6. That of Trophonius in Bœotia; 7. That of Venus of Aphaca, a country between Byblos and Heliopolis, situate on a small lake; and a great number of other oracles of less note, dispersed over Greece and other countries. It also examines in what manner these oracles gave their answers, the ceremonies that were observed in consulting them, the frantic emotions of the priestesses Pythia on her tripod; and those of other priests. It then endeavours to determine if there ever were in fact any Sibyls, which, whatever has been said, is still very doubtful; it draws, however, from all the sources of antiquity, a kind of history of these Sibyls, and of their prophecies. It next passes to the examen of the nature of auguries, auspices, haruspices, presages, prodigies, and phenomena, of expiations and ablutions, of the magic and astrology of the ancients, &c. Whoever has thoroughly studied all these objects, is fully provided with the preliminary knowledge that is necessary to enable him to proceed steadily and securely through the darkness of ancient mythology, and he may thereby advance more confidently to the examination of the nature of the pagan divinities themselves.

The celebrated treatise of Cicero *De natura Deorum* will here furnish great lights: but modern authors who have treated on these matters, have not been contented with this alone: they have, so to say, extracted the essence of all antiquity, of which they have formed systems; but unluckily these scarce ever agree with each other. As philosophers, it is of very little importance for us to know what was the nature of these gods, seeing we know that they were merely fabulous: but as historians and antiquaries, it concerns us to know what was the nature that was attributed to them in general; and, in particular, what were the origin, genealogy, rank, functions, authority, and operations, that were attributed to each divinity; and it is on these matters that we have still some remarks to make.

The gods of the ancient Greeks and Romans were all either *Dii majorum gentium*, or *Dii minorum gentium*; that is, of the first or second order. The former were also called *consentes*, *magni consultores*, &c. According to Ennius they were twelve in number, and are included in these verses:

Juno, Vesta, Minerva, Ceres, Diana, Venus, Mars, Mercurius, Jovis, Neptunus, Vulcanus, Apollo.

To these were added eight others under the title of *selesti*, which were Sol, Luna, Tellus, Genius, Janus, Saturnus, Liber, and Pluto. The second order, or *minorum gentium*, were called *Adscriptitii*, *Medioximi*, *Minufcularii*, *Putatitii*, *Indigetes*, *Semones*, &c. the principal of which were Æsculapius, Bacchus, Castor, Fauna, Hercules,

tes, the Lares or Penates, Pollux, Quirinus, Semo Sanctus or Dius Fidius, &c.

According to the second division, all their divinities were classed into, 1. Celestial gods, 2. Terrestrial gods, 3. Sea gods, and 4. The Infernal deities, or *inferi*. The celestial gods were Jupiter, Juno, Apollo, Aurora, Cupid, Cybele, the Graces, Hebe, Iris, Luna, Mars, Mercury, Minerva, Nemesis, Saturn, Themis, Venus, &c. The terrestrial gods were Æolus, Astræus, Astræa, Ceres, Diana, the Fauni, Feronia, Flora, Janus, Momus, the Muses, Pales, Pan, Pomona, Priapus, the Satyrs, Silenus, Silvanus, the god Terminus, Vesta or Rhea, Berecynthia, Vulcan, Harpocrates, &c. The sea-gods were Neptune, Amphitrite, Thetis, Canopus, Glaucus, Ino, the Nereids, Nereus, Oceanus, Palæmon, Triton, &c. The infernal gods were Pluto, Proserpine, Charon, Minos, Æacus, Rhadamanthus, the Furies, Death, Night, the Fates, Plutus, &c.

The third division ranged the divinities according as they presided, 1. Over the pregnancy of women (*Prægnantium*); 2. At parturitions (*Parturientium*); 3. At births (*Nascentium*); 4. At adulteries; 5. At marriages: To which they added, 7. Dii morales, or moral gods; and 7. Funerary gods. The gods of pregnancy were Pilumnus, Intercidona, and Deverra: the gods of parturition, Juno, Lucina, Diana, Egerio, Prosa, Postverta, Menaginata, Latona, the gods that were called Nixi, or of labour, &c. The gods of birth were Janus, Opis, Nascion, Cunina, Carmenta, Vaginianus, Levana, Rumia, Potina, Educa, Osilago, Carne, Nundina, Statilinus, Fabulinus, Paventia, &c. The gods of adultery were Juvëntus, Agenoria, Srenua, Stimula, Horta, Quies, Murcia, Adeona, Abeona, Voluptas, Orbona, Pellonia, Numeria, Camoena, Sentia, Angerona, Heres, Martea, Laverna, the god Averruncus, Confus, Catius, Volumnus and Volumna, Honorius, Aius Locutius, &c. The nuptial gods were Diana, Domiduca, Domitius, Hymenæus or Hymen, Juzatinus, Jupiter perfectus, Juno perfecta, Juno cinxia, Juna unxia, Lucina, Manturna, Mutinus, Dea Mater prima, Suada, Thalassius, Venus, &c. The moral gods were called Virtus, Honor, Fides, Spes, Justitia, Pietas, Misericordia, Clementia, Pudicitia, Veritas, Mens, Concordia, Pax, Salus, Felicitas, Libertas, Pecunia, Rufus, Invidia, Contumelia, Impudentia, Calumnia, Fraus, Discordia, Furor, Fama, Fortuna, with all their epithets good or bad, Febris, Pavor and Falor, Paupertas, Neçessitas, Tempestas, Silentium, &c. The funeral gods were Pluto, Libitina, Nænia, Death, the Fates, &c.

Hesiod indeed pretends that all these gods derived their origin from chaos; but we have already pointed out more just sources. It is almost incredible to what a prodigious number the superstition and weakness of the Greeks and Romans multiplied these divinities: there have been thirty thousand of them enumerated. It will not be expected that we should here attempt to describe them, nor will it be remarkable if we have forgot to mention even some of the first rank: Although, vast as this company of gods is, mythology does not omit to trace the history of the greatest part of them, as is taught by paganism; and they who are desirous of particular information in these mat-

ters may consult with advantage the theogony of Hesiod, the catalogue of Apollodorus, the metamorphoses of Ovid, the fables of Hygina, Lylii Gregorii Gyraldi Synagmæ de Diis Gentilium, the mythology of Natalis Comes, the books of Gerard Vossius de Idolatria Gentilium, Johannis Boccatii Genealogia Deorum, the Pantheon of Pomey, the history of heaven by Abbe Pluche, the historic explanation of fables by Abbe Banier, and numberless other works of the same kind in all languages.

There were still many other distinctions, of which the pagans made use to mark the rank, the functions and nature of their several divinities. For example, the goddess Vesta, or the mother of all the gods, was adored by all people in general. Mars, Bellona, Victoria, Fortunata, &c. assisted all parties. The topical gods, on the contrary, were adored in particular countries only; as Astarte in Syria, Derceto and Semiramis among the Assyrians, Isis and Osiris by the Egyptians, Quirinus at Rome, &c. The title Semoes, which was given to a certain class of divinities, was doubtless derived from Semi-homines, that is, demi-men; and signified the same as semi-dii, or demi-gods. These were monarchs and illustrious heroes, or those great men who were the founders of cities and nations, that were deified by way of apotheosis. Pythagoras had taught the Chaldeans the doctrine of transmigration; and that, after their death, those who were virtuous would be elevated to the rank of divinities. This doctrine was adopted by all the pagan world. The apotheosis, after they had erected temples and altars to the new gods, was celebrated with much solemnity. In the last ceremony, an eagle was fixed on the catafalk, or funeral pile, on which was placed the image of the hero; and when the pile began to burn, the eagle was let loose, who, mounting into the air with the flames, seemed to carry the soul of the departed hero up to heaven.

Mythology informs us also, who those persons were that antiquity regarded as the children of the gods, such as Theseus, Hippolytus, Paris, &c.; what the pagans believed with regard to the nature of their Genii and Demons, of their Dryades, Hamadryades, Nymphs, Tritons, Sirens, Fauns, Sylvans, Centaurs, and other subaltern divinities; and in this manner it explains all the systems of the positive religion of the Greeks and Romans. They who are desirous of extending their knowledge of paganism still further, of knowing the dogmas of each particular people, what were their gods, and the various manners in which they were worshipped, such as Apis, Isis, Osiris, &c. the adoration of crocodiles and onions, &c. among the Egyptians, must study the different theogonies of these people; and notwithstanding all the informations which ancient and modern authors afford, this study is yet boundless, and attended with many difficulties and uncertainties: Though it appears demonstrative, that the origin of paganism, and of idolatry in general, was derived from the Chaldeans, from whom the Egyptians drew that doctrine which they after transmitted to all other nations; and consequently that the primordial divinities were the same, under different denominations, among all the idolatrous nations of the earth.

The nature of this work will not permit us to descend to further particulars. But to give our readers an idea

of the manner in which mythology treats its subjects, and of the method that should be observed in studying fable, or the history of the gods of antiquity, we shall here give, by way of example, a cursory description of Parnassus and its inhabitants.

Parnassus was a mountain of Phocis, that had two summits, one of which was called Tithoreus, and the other Hyampeus. Others say, that one of these hills was named Helicon, and the other Cytheron; and that it is an error to imagine, that Helicon was a mountain of Bœotia. However that be, this double hill was consecrated to Apollo and the Muses, who there held their usual residence. According to fable, there had been a remarkable combat on this hill, between Helicon and Cytheron. Whoever slept on Parnassus, when he waked, became a poet. Apollo had there a temple. There also was the fountain Castalia, into which Apollo had metamorphosed a nymph that he loved, and had given to its waters the power of making all who drank of them poets. At the foot of Parnassus flowed the river Hippocrene, that had the same virtue; and the source of which was opened by a stroke of the foot of the horse Pegasus. This river nourished a great number of swans, that were regarded as sacred. Pegasus was a winged horse, that belonged to Apollo, and grazed on the summit of Parnassus. He sprang from the blood of Medusa, when Perseus cut off her head, which was placed among the stars. Such was the delicious abode of Apollo, the son of Jupiter and Latona, who was born, with his twin sister Diana, in the island Delos. He killed the Cyclops, who forged the thunderbolts with which Jupiter had overthrown his son Æsculapius; but for that presumption, he was forced to leave heaven, and become an inhabitant of the earth. He guarded the oxen of Admetus; he aided Neptune to build the walls of Troy, and Alceus in forming the labyrinth. He killed the dragon or serpent Python. He invented Musick and physick; and was honoured as the god of poets and physicians. He was represented as a young man without a beard, his head surrounded with rays, and bearing in his hand a bow, or a lyre. As the ancients denoted the sun by the name of Apollo, they sometimes represented him also as seated in a chariot, drawn by two white horses, preceded by Aurora and the star Venus: Phaeton his son, being desirous of conducting these horses, was thrown into the sea. Apollo was also called Phœbus, Titan, and Sol. He is known to have had amours with Arctinoë, Corycia, Melœne, Cyrene, Mantho, Sinope, Calliope, and others; by whom he had Delphe, Naxe, Miletus, Arabe, Garamas, Sirius, Linus, Orpheus, and other children. He had peculiar honours paid him in the Pythian games at Delphos, and in the secular games at Rome.

The Muses were the companions of Apollo in his rural abode. They were likewise called the learned sisters; as also the Camœnon, Heliconian, Parnassian, Aonian, Pierian, Pegasusian, Aganippian, Theopian, Libethrian, and Castalian sisters. They were the daughters of Jupiter and Mnemosyne, and were regarded as the goddesses of sciences and arts in general. There were nine of these

Muses; to whom they attributed, 1. to Clio, history, 2. to Melpomene, tragedy, 3. to Thalia, comedy, 4. to Euterpe, flutes and other pneumatic instruments of musick, 5. to Terpsichore, the harp and the dance, 6. to Erato, the lyre and the lute, 7. to Calliope, heroic verse, 8. to Urania, astronomy, and 9. to Polyhymnia, rhetoric and eloquence. The Graces also sometimes quitted Venus to pay their court to Apollo.

Such was the idea they entertained of Parnassus and its inhabitants. There is no doubt but that, under these fabulous representations, these sensible images, were concealed allegoric and moral meanings; nor can it be denied but that their method of cultivating the arts and sciences, by this manner of expressing their ideas, was as ingenious and pleasing as it is possible to imagine. Every other subject that paganism embraced, it treated with the same genius, and in a manner equally pleasing; and though that religion was altogether fallacious, yet we must allow that it was extremely well calculated to promote the polite arts, by those refined, noble, graceful, brilliant images, by those charming subjects, which it constantly presented, and which it still offers to the poet, painter, sculptor, and every other artist.

But this was not a power sufficiently strong to secure paganism against that vicissitude, that decline and dissolution, which finally attends all the productions of this world. This religion, which had subsisted near five thousand years, and almost from the origin of the human race, gradually declined in proportion as the lights of Christianity and philosophy illumined the minds of mankind. For though the pagan religion, and the fables on which it was founded, were pleasing and favourable to the polite arts, they were not however calculated to satisfy the minds of philosophers, nor to promote the real good of mankind, by securing their temporal and eternal happiness. It is even surprising that so great a genius as the emperor Julian should attempt to revive the embers of paganism, which insensibly declined, and had received a mortal blow at the beginning of the fourth century by the emperor Constantine the great. Julian employed all the resources of his imagination, of his eloquence, of his power, and even of his own fatal example, to revive it; but in vain. The fatal period of paganism was arrived, and nothing could save it from destruction. The furious Theodosius, to whom bigotted priests and historians have assigned the name of Great, totally overthrew it toward the close of the same century, destroyed those temples and altars which yet subsisted, dispersed its colleges, and exterminated its priests. From that dire epoch, nothing of paganism has remained, except some ruins dispersed in the remote parts of the earth, and among people wretched and almost unknown; where this religion, once so flourishing and universal, is now degenerated into gross and disgusting idolatry.

MYURUS, in medicine, an epithet for a sort of sinking pulse, when the second stroke is less than the first, the third than the second, and so on.

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## N A M

**NATABOB**, a viceroy or governor of one of the provinces of the Mogul's empire, in India.

**NABONASSAR**, or *Æra of NABONASSAR*. See **ASTRONOMY**, p. 493.

**NADIR**, in astronomy, that point of the heavens which is diametrically opposite to the zenith, or point directly over our heads. See **ASTRONOMY**, p. 435.

**NÆVI**, in surgery, marks or excrescences made on the skin of an infant before its birth, vulgarly supposed to be occasioned by the imagination of the mother.

**NAHUM**, or *the prophecy of NAHUM*, a canonical book of the Old Testament.

Nahum, the seventh of the twelve lesser prophets, was a native of Elkothai, a little village of Galilee. The subject of his prophecy is the destruction of Nineveh; which he describes in the most lively and pathetic manner; his style is bold and figurative, and cannot be exceeded by the most perfect masters of oratory. This prophecy was verified at the siege of that city by Assyages, in the year of the world 3378, 622 years before Christ.

**NAIADS**, in mythology, the nymphs of the fountains. See **MYTHOLOGY**.

**NAIANT**, in heraldry, a term used in blazoning fishes, when borne in an horizontal posture, as if swimming.

**NAJAS**, in botany, a genus of the monœcia monandria class. The calix of the male is cylindrical and bifid; the corolla consists of four segments; and there are no filaments: The female has neither calix nor corolla, but one pistil and an ovated capsule. There is only one species, *viz.* the marina, found in the European seas.

**NAIL**, *unguis*, in anatomy. See **ANATOMY**, p. 256.

**NAILS**, in building, &c. small spikes of iron, brass, &c. which being drove into wood, serve to bind several pieces together, or to fasten something upon them.

**NAIL**, is also a measure of length, containing the sixteenth part of a yard.

**NAIRN**, a borough and port town of Scotland, eighteen miles east of the town of Inverness.

**NAISSANT**, in heraldry, is applied to any animal issuing out of the midst of some ordinary, and shewing only his head, shoulders, forefeet and legs, with the tip of his tail; the rest of his body being hid in the shield, or some charge upon it; in which it differs from issuant, which denotes a living creature arising out of the bottom of any ordinary or charge.

**NAKED SEEDS**, in botany, are those that are not inclosed in any pod or case.

**NAMA**, in botany, a genus of the pentandria digynia class. The calix consists of five leaves, and the corol-

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la of five segments; and the capsule has one cell and two valves. There are two species, none of them natives of Britain.

**NAME**, denotes a word whereby men have agreed to express some idea; or which serves to signify a thing or subject spoken of. See **GRAMMAR**.

**NAMUR**, a strong city of the Austrian Netherlands, capital of the province of Namur, situated at the confluence of the Sambre and Maese: E. long. 4° 50', N. lat. 50° 30'.

**NANCY**, the capital of Lorraine in Germany, situated in E. long. 6°, N. lat. 48° 44'.

**NANTO**, one of the islands in the Archipelago, sixteen miles round, and situated in E. long. 26°, N. lat. 35°.

**NANKING**, the capital of the province of Nanking, and formerly of the Empire of China, is situated in E. long. 118° 30', N. lat. 32°.

**NANSAMUND**, a county of Virginia, in North America, south of the Isle of Wight county, through which the river of Nansamund runs.

**NANTZ**, a city of France in the province of Brittany, situated on the river Loire, in W. long. 1° 30', N. lat. 47° 15'.

**NANTWICH**, a market town of Cheshire, situated seventeen miles south-west of Chester.

**NAPÆA**, in botany, a genus of the monadelphia polyandria class. The calix is simple and cylindrical; and the capsule contains one seed. There are two species, none of them natives of Britain.

**NAPHTHA**, in natural history, a fluid mineral body, of a thin consistence, bright and pellucid, of a strong smell, very readily inflammable, and, when pure, burning away without leaving any residuum.

The naphtha is found in considerable quantities floating on the water of certain springs, principally breaking out at the sides of hills in Persia, Tartary, and some parts of the empire of China; where if a lighted candle be held near the surface, it takes fire and overspreads the surface of the water for a great extent, with a strong white flame, and emits a very disagreeable smell. The genuine naphtha is very rare in Europe; it is not known to be any where naturally produced here, and what we see of it is generally sophisticated. Distilled by the retort, it yields an oil somewhat thinner than it was originally, and of a weaker smell. The substance remaining at the bottom of the retort, has much the resemblance of amber; and Dr Hill thinks it highly probable, that the origin of all the amber is from the same sort of principle; nay, he tells us that he has succeeded

ceeded so far in an attempt to make amber by this fluid and an acid drawn from the crude pyrites, that he has produced a friable somewhat pellucid matter, having all the properties of amber except its hardness and clearness, and yielding a true salt and oil of amber on distillation.

The medicinal virtues of the naphtha are the same with the common petroleum, but in a more remiss degree. It is used externally on many occasions in Persia; and is taken inwardly, a few drops for a dose, in colics. The principal use made of it, however, is burning in lamps, for which purpose it is very proper.

MAPIER'S, or NEPER'S BONES. See NEPER.

NAPLES, the capital of the kingdom of Naples: situated in E. long. 15°, N. lat. 41°.

The kingdom of Naples is one of the Sicilies; it is the south-east part of Italy, and is situated between 14° and 19° E. long. and between 38 and 34° N. lat. being bounded by the gulph of Venice on the north-east, by the Mediterranean sea on the south-east, by Sicily and the Tuscan sea on the south-west, and by the Pope's territories on the north-west; and divided from the islands of Sicily only by the narrow strait of Pharo or Messina.

NARBARTH, a town of Pembroke-shire, in south Wales, situated ten miles north east of Pembroke.

NARBONNE, a city of France, in the province of Languedoc: situated in E. long. 2° 40', N. lat. 43° 13'.

NARBOROUGH, an island of South-America, in the Pacific Ocean, situated on the coast of Chili, in W. long. 85°, S. lat. 45°.

NARCISSUS, the DAFFODIL, in botany, a genus of the hexandria monogynia class. The corolla consists of six leaves, and the nectarium of one entire funnel-shaped leaf; and the stamina are situate within the nectarium. There are 13 species, only two of which are natives of Britain, *viz.* the poeticus, common pale daffodil, or primrose peerless; and the pseudo-narcissus or wild English daffodil.

NARCOTICS, in medicine, soporiferous medicines, which excite a stupefaction.

Narcotics, called also hypnotics, anodynes, or stupefactive, are said, by Hoffman, to be such kind of remedies as, by their subtle, noxious, and deleterious exhalations, diminish, or quite destroy, the sense and motion of the solid parts. Among narcotics, the most eminent are those which are usually prepared for medicinal uses of the whole poppy, especially opium; as also all those prepared of mandragoras, hyoscyamus, stramonium, and datura.

NARDO, a port town of Italy, in the kingdom of Naples: E. long. 19°, N. lat. 40° 33'.

NARDUS, in botany, a genus of the triandria monogynia class. It has no calix, and the corolla consists of two valves. There are five species, only one of which, *viz.* the stricta, or malt-grass is a native of Britain.

NARRATION, in oratory and history, a recital or rehearsal of a fact as it happened, or when it is supposed to have happened. See DESCRIPTION.

NARWAL, in ichthyology. See MONODON,

NARVAR, a city of the Lither India, the capital of the province of Narvar: E. long. 79°, N. lat. 25'.

NASIAS, in anatomy, a thin bone, making the upper part of the nose. See ANATOMY, p. 160.

NASSAU, the capital of the county of the same name in Germany: E. long. 7° 25', N. lat. 50° 21'.

NASSUS, in ichthyology. See CYPRINUS.

NATES, in anatomy, a term expressing those two fleshy exterior parts of the body vulgarly called the buttocks.

NATES CEREBRI. See ANATOMY, p. 286.

NATION, a collective term, used for a considerable number of people inhabiting a certain extent of land, confined within fixed limits, and under the same government.

NATIVE, a person considered as born in a certain place which was the proper residence of his parents, and where he received his education.

NATIVITY, or NATAL DAY, the day of a person's birth: The word nativity is chiefly used in speaking of the saints, as the nativity of St. John the Baptist, &c. But when we say the Nativity, it is understood of that of Jesus Christ, or the feast of Christmas.

NATOLIA, the modern name of the Lesser Asia, being the most westerly part of Turkey in Asia, and consisting of a large peninsula, which extends from the river Euphrates, as far as the Archipelago, the seas of Marmora, the straits of Galipoli and of Constantinople, which separate it from Europe on the west. It is bounded on the north by the Black-Sea, and on the south by the Mediterranean sea.

NATRIX, in zoology. See COLUBER.

NATRUM, the nitre of the ancients, in natural history, is a genuine, pure and native salt, extremely different from our nitre, and indeed from all the other native salts; it being a fixed alkali, plainly of the nature of those made by fire from vegetables, yet capable of a regular crystallization, which those salts are not. It is found on the surface of the earth, or at very small depths within it; and is naturally formed into thin and flat cakes or crusts, which are of a spongy or cavernous substance, very light and friable, and, when pure, of a pale brownish-white; but as its spongy texture renders it very subject to be fouled by earth received into its pores, it is often met with of a deep dirty brown, and not unfrequently reddish.

Natrum, whether native or purified, dissolves in a very small quantity of water; and this solution is, in many parts of Asia, used for washing; where it is also made into soap, by mixing it with oil. Natrum reduced to powder, and mixed with sand or sifts, or with any other stone of which crystal is the basis, make them readily run into glass, Gold heated red hot, and sprinkled with a small quantity of this salt, melts immediately; silver ignited and sprinkled with it, melts in the same manner; as does also iron, copper, and the regulus of antimony, which melt much more easily than they otherwise would do. Mercury will not be mixed with it by any art, and indeed will not amalgamate with metals if only a little of this salt be added. It is found in great abundance in many parts of Asia, where the natives sweep

it up from the surface of the ground, and call it soap-earth. The earliest account we have of it is in the Scriptures, where we find that the salt called nitre in those times would ferment with vinegar, and had an absterfve quality, so that it was used in baths and in washing things. Solomon compares the singing of

songs with a heavy heart, to the contrariety of vinegar and nitre; and Jeremiah says, that if the sinner wash himself with nitre, his sin is not cleaned off. These are properties that perfectly agree with this salt, but not at all with our salt petre.

## N A T U R A L H I S T O R Y.

**N**ATURAL HISTORY, is that science which not only gives compleat descriptions of natural productions in general, but also teaches the method of arranging them into Classes, Orders, Genera, and Species. This definition includes Zoology, Botany, Mineralogy, &c. But, in a work of this kind, we thought it would be easier, and more advantageous to the reader, to treat these branches of natural history separately under their respective names. See BOTANY, &c. Under the title of NATURAL HISTORY, therefore, we shall confine ourselves to ZOOLOGY, or that part of it which relates to *Animals*. It is likewise necessary to mention in this place, that we have given the descriptions and characters of animals under their proper names. The scientific part of the subject, therefore, or the method of investigating the genera or species of animals, by means of natural or artificial arrangement, only remains to be explained.

In order to abridge the study of zoology, many methods of reducing animals to classes, genera, and species, have been invented. But, as that of Linnæus is undoubtedly the best, the most extensive, and the least understood, we shall give a brief account of it.

Linnæus divides the whole animal kingdom into 6 classes. The characters of these 6 classes are taken from the internal structure of animals, in the following manner.

**CLASS I. MAMMALIA**, includes all animals that suckle their young. The characters of this class are these:—The heart has two ventricles and two auricles; the blood is red and warm; and the animals belonging to it are *viviparous*.

**CLASS II. AVES, or BIRDS.**—The characters are the same with those of Class I. excepting that the animals belonging to it are *oviparous*.

**CLASS III. AMPHIBIA, or AMPHIBIOUS ANIMALS.**—The heart has but one ventricle and one auricle; the blood is red and cold; and the animals belonging to this class have the command of their *lungs*, so that the intervals between *inspiration* and *expiration* are in some measure *voluntary*.

**CLASS IV. PISCES, or FISHES.**—The heart has the same structure, and the blood the same qualities with those of the *Amphibia*; but the animals belonging to this class are easily distinguished from the *Amphibia*, by having no such voluntary command of their *lungs*, and by having external *branchiæ* or *gills*.

**CLASS V. INSECTA, or INSECTS.**—The heart

has *one ventricle*, but no *auricle*; the blood is cold and white; and the animals are furnished with *antenna*, or *feelers*.

**CLASS VI. VERMES, or WORMS.**—The characters are the same with those of Class V. only the animals have no antennæ, and are furnished with *tentacula*.

The *First Class*, MAMMALIA, is subdivided into 7 ORDERS; the characters of which are taken from the number, structure, and situation of the TEETH.

**ORDER I. The PRIMATES**, have 4 incisors, or *fore-teeth*, in each jaw, and one *dog-tooth*. N. B. By *one dog-tooth*, Linnæus means one on each side of the fore-teeth in both jaws.—This order includes 4 genera, *viz.* Homo, Simia, Lemur, Vespertilio. See these articles.

**ORDER II. The BRUTA**, have no *fore-teeth* in either jaw.—This order includes 6 genera, *viz.* Elephas, Trichechus, Bradypus, Myrmecophaga, Manis, Dasypus. See these articles.

**ORDER III. The FERÆ**, have, for the most part, 6 *conical fore-teeth* in each jaw.—This order includes 10 genera, *viz.* Phoca, Canis, Felis, Viverra, Mustela, Ursus, Didelphis, Talpa, Sorex, Erinaceus. See these articles.

**ORDER IV. The GLIRES**, have 2 *fore-teeth* in each jaw, and no *dog-teeth*.—This order includes 6 genera, *viz.* Hystrix, Lepus, Castor, Mus, Sciurus, Noctilio. See these articles.

**ORDER V. The PECORA**, have no *fore-teeth* in the upper jaw, but 6 or 8 in the under-jaw.—This order includes 6 genera, *viz.* Camelus, Moschus, Cervus, Capra, Ovis, Bos. See these articles.

**ORDER VI. The BELLUÆ**, have *obtuse fore-teeth* in each jaw.—This order includes 4 genera, *viz.* Equus, Hippopotamus, Sus, Rhinoceros. See these articles.

**ORDER VII. The CETÆ, or whale kind**, have no uniform character in their teeth, being very different in the different genera; but are sufficiently distinguished from the other orders of Mammalia, by living in the ocean, having pectoral fins, and a fistula or spiraculum upon the head.—This order includes 4 genera, *viz.* Monodon, Balæna, Phyfeter, Delphinus. See these articles.

The generic characters of the Mammalia are, like those of the orders, almost entirely taken from the TEETH, excepting

excepting the Vespertilio, which, besides the character of of the order derived from the teeth, has this further mark, that there is a membrane attached to the feet and sides, by means of which the creature is enabled to fly;—the Hyltrix, whose body is covered with sharp spines;—and the whole order of Pecora, whose genera, besides the characters taken from the teeth, are distinguished into those which have *horns*, those which have *no horns*, and by peculiarities in the horns themselves.

The *specific* characters are very various, being taken from any part of the body which possesses a peculiar uniform mark of distinction. As examples of these characters are to be found under the proper name of each genus, it is unnecessary to say any thing further concerning them in this place.

The *Second Class*, AVES, is subdivided into six ORDERS, the characters of which are taken chiefly from the structure of the BILL.

ORDER I. The ACCIPITRES, have a HOOKED BILL, the superior mandible, near the base, being extended on each side beyond the inferior; and in some, the superior mandible is armed with *teeth*.—This order includes 4 species, *viz.* Vultur, Falco, Strix, Lanius. See these articles.

ORDER II. The PICÆ, have a convex, compressed BILL, resembling a knife.—This order contains 22 genera, *viz.* Buphaga, Certhia, Corvus, Cuculus, &c. See these articles.

ORDER III. The ANSERES, have an obtuse BILL, gibbous at the base, broadest at the point, covered with a smooth skin, and furnished with teeth: The *tongue* is fleshy; and the toes are palmated, or webbed.—This order includes 12 genera, *viz.* Alca, Anas, Colymbus, Diomedea, &c. See these articles.

ORDER IV. The GRALLÆ, have a long, obtuse, and somewhat cylindrical BILL: The *tongue* is undivided, and fleshy; and the *shins* are naked. This order contains 18 genera, *viz.* Ardea, Fulica, Tringa, Charadrius, &c. See these articles.

ORDER V. The GALLINÆ, have a convex BILL; the superior mandible is vaulted over the inferior, and the margin of the superior mandible folds over the inferior one: The *nostrils* are half covered with a convex cartilaginous membrane: The *rectrices*, or principal quill-feathers of the tail, are always more than twelve in number; and the *feet* are divided, but connected at the inmost joint.—This order contains 7 genera, *viz.* Didus, Phasianus, Meleagris, Pavo, &c. See these articles.

ORDER VI. The PASSERES, have a conical sharp-pointed BILL; and the *nostrils* are oval, wide, and naked.—This order contains 15 genera, *viz.* Caprimulgus, Alauda, Columba, &c. See these articles.

The *generic* characters of this class are taken from peculiarities in the *bill*, the *nostrils*, the *tongue*, the *feet*, the *feathers*, the *face*, the *figure of the body*, &c.

The characters which serve to distinguish the *species*

are very various: For example, the *colour* of particular *feathers* or parts of *feathers*; *crests* of feathers on the head, disposed in different manners; the colour of the *cere* or *wax*; the colour of the *feet*; the shape and length of the *tail*; the number, situation, &c. of the *toes*; the colour and figure of the *bill*; &c.

The *Third Class*, AMPHIBIA, is divided into four ORDERS.

ORDER I. The REPTILES, have *legs*, and breathe by the *mouth*.—This order contains 4 genera, *viz.* Testudo, Draco, Lacerta, Rana. See these articles.

ORDER II. The SERPENTES, have no *legs*, and breathe by the *mouth*.—This order contains 6 genera, *viz.* Crotalus, Boa, Coluber, Anguis, Amphibæna, Cœcilia. See these articles.

ORDER III. The NANTES, are furnished with *lungs*, and at the same time breathe by lateral *gills*; and the rays of their fins are cartilaginous.—This order contains 14 genera, *viz.* Accipenser, Balistes, &c. See these articles.

ORDER IV. The MEANTES, have both *lungs* and *gills*; and the *feet* are furnished with *toes* and *claws*.—This order contains but one genus, *viz.* the Siren. See SIREN.

The *generic* characters of this class are taken from the general figure of the *body*; from their having *tails* or *no tails*; being covered with a *shell*; having *teeth* or *no teeth* in the *mouth*; being furnished with *wings*; having *covered* or *naked* bodies; from the number, situation, and figure of the *scuta* and *scales*; from the number and situation of the *spiracula*; from the situation of the *mouth*, &c.

The *specific* characters are so very various, that it would be superfluous to enumerate them.

The *Fourth Class*, PISCES, is subdivided into four ORDERS, the characters of which are taken from the situation of the *belly-fins*.

ORDER I. The APODES, have no *belly-fins*.—This order contains 8 genera, *viz.* Ammodytes, Anarrhicas, Muræna, &c. See these articles.

ORDER II. The JUGULARES, have the *belly-fins* placed before the *pectoral fins*.—This order includes 5 genera, *viz.* Callionymus, Blennius, Gadus, &c. See these articles.

ORDER III. The THORACICI, have the *belly-fins* placed under the *pectoral fins*.—This order comprehends 17 genera, *viz.* Gobiis, Labrus, Sparus, &c. See these articles.

ORDER IV. The ABDOMINALES, have the *belly-fins* placed behind the *pectoral fins*. This order contains 17 genera, *viz.* Fistularia, Esox, Clupea, Cyprinus, &c. See these articles.

The *generic* characters of this class are taken from peculiarities in the *head*, the *mouth*, the *teeth*, the *nostrils*, the *rays* in the *membrane of the gills*, the *eyes*, the general figure of the *body*, the figure of the *tail*, the situation of the *spiracula*, &c.

The *specific* characters are taken from peculiarities in all the parts above enumerated, and many others.

The *Fifth Class*, INSECTA, is subdivided into 7 ORDERS, the characters of which are taken from the wings.

ORDER I. The COLEOPTERA, have *four wings*, the two superior ones being crustaceous, and furnished with a *straight future*.—This order comprehends 40 genera, *viz.* Attelabus, Scorabæus, Coccinella, Melœ, &c. See these articles.

ORDER II. The HEMIPTERA, have *four wings*, the two superior ones being *semicrustaceous*, and *incumbent*, i. e. the *interior edges* lie above one another.—This order includes 12 genera, *viz.* Blatta, Gryllus, Cicada, &c. See these articles.

ORDER III. The LEPIDOPTERA, have *four wings*, all of them imbricated with *scales*.—This order contains 3 genera, *viz.* Papilio, Sphinx, Phalœna. See these articles.

ORDER IV. The NEUROPTERA, have *four wings* interwoven with veins, like a piece of *network*, and *no sting* in the *anus*.—This order includes 7 genera, *viz.* Libella, Ephemera, Hemerobius, &c. See these articles.

ORDER V. The HYMENOPTERA, have the same characters with the former, only the *anus* is armed with a *sting*. But this mark is peculiar to the *females* and *neuters*; for the *males* have *no sting*.—This order comprehends 10 genera, *viz.* Apis, Formica, Vespa, &c. See these articles.

ORDER VI. The DIPTERA have *two wings*, and *two clavated halteres* or *balances* behind each wing.—This order contains 10 genera, *viz.* Combylius, Afilus, Tipala, &c. See these articles.

ORDER VII. The APTERA, have *no wings*. This order contains 14 species, *viz.* Acarus, Araneæ, Pediculus, &c. See these articles.

The *Sixth Class*, VERMES, is divided into five ORDERS.

ORDER I. The INTESTINA, are the most *simple animals*, being perfectly *naked*, and without *limbs* of any kind.—This order contains 7 genera, *viz.* Lumbrius, Spinuſculus, Falcioſa, Gordius, Aſcaris, Hirudo, Mycine. See these articles.

ORDER II. The MOLLUSCA, are likewise *simple naked animals*, without any *shell*; but they are *brachiated*, or furnished with a kind of *limb*.—This order comprehends 18 genera, *viz.* Aſcidia, Limare, Doris, Tethys, Aphrodita, Sepia, &c. See these articles.

ORDER III. The TESTACEA, have the same characters with those of Order II. but are covered with a *shell*.—This order includes 39 genera, *viz.* Anomia, Cardium, Argonauta, Bulla, Buccinum, &c.

ORDER IV. The LITHOPHYTA, are *compound animals*, fixed upon a *calcareous base* constructed by the creatures *themselves*.—This order includes the corals, of which there are 4 genera, *viz.* Tubipora, Madrepora, &c. See these articles.

ORDER V. The ZOOPHYTA, are *compound animals*, furnished with a kind of *flowers*, and having a *vegetating root* and *stem*.—This order contains 15 genera, *viz.* Spongia, Gorgonia, Tubularia, Hydra, &c. See these articles.

This short explanation will enable any person who understands the Latin language to peruse the *Systema Naturæ* of Linnæus without the assistance of a master; which was the principal object of this article.

## N A T

NATURAL PHILOSOPHY, that which considers the powers and properties of natural bodies, and their mutual actions on one another. See MECHANICS, OPTICS, ASTRONOMY, HYDROSTATICS, PNEUMATICS.

NATURALIZATION. See LAW, Tit. x, 6.

NATURALS, among physicians, whatever naturally belongs to an animal, in opposition to non-naturals. See NON-NATURALS.

NATURE, according to Mr. Boyle, has eight different significations; it being used, 1. For the Author of nature, whom the schoolmen call *Natura Naturans*, being the same with God. 2. By the nature of a thing, we sometimes mean its essence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature, with what accrues to him by birth; as when we say, that such a man is noble by nature. 4. Sometimes we take nature for an internal principle of motion; as when we say, that a stone by nature falls to the earth. 5. Sometimes we understand, by nature, the established course of things. 6. Sometimes we take nature for an aggregate of pow-

## N A T

powers belonging to a body, especially a living one; in which sense physicians say, that nature is strong, weak, or spent; or that, in such or such diseases, nature left to herself will perform the cure. 7. Sometimes we use the term nature for the universe, or whole system of the corporeal works of God; as when it is said of a phoenix, or chimera, that there is no such thing in nature. 8. Sometimes too, and that most commonly, we express by the word nature a kind of semi-deity, or other strange kind of being.

If, says the same philosopher, I were to propose a notion of nature, less ambiguous than those already mentioned, and with regard to which many axioms relating to that word may be conveniently understood, I should first distinguish between the universal and the particular nature of things. Universal nature I would define to be the aggregate of the bodies that make up the world, in its present state, considered as a principle; by virtue whereof they act and suffer, according to the laws of motion prescribed by the Author of all things. And this makes way for the other subordinate notion; since the particular nature of an individual consists in the general nature applied to a distinct portion of the universal

universe; or, which is the same thing, it is a particular assemblage of the mechanical properties of matter, as figure, motion, &c.

NAVARINO, a port-town of European Turkey in the Morea, ninety-miles south-west of Corinth.

NAVARRÉ, a province of Spain, bounded by French Navarre on the north-east, by Arragon on the south-east, by Old Castile on the south-west, and by Guipuscoa on the west: it is a mountainous country.

French Navarre, separated from Spanish Navarre on the south-west by the Pyrenees: it is only thirty miles long, and fifteen broad; being one of the most barren provinces in France.

NAVE, in architecture, the body of a church where the

people are disposed, reaching from the balluster, or rail of the choir, to the chief door.

NAVEL, in anatomy, the centre of the lower part of the abdomen; being that part where the umbilical vessels passed out of the fetus to the placenta of the mother. See MIDWIFERY.

NAVEL-WORT, in botany. See COTYLEDON.

NAVREINI, a town of Gascony, in France, sixteen miles south-east of Bayonne.

NAVEW, in botany. See BRASSICA, of which it is a species.

NAVICULARÉ OS, in anatomy. See ANAT. p. 186.

NAVIDAD, a port-town of Mexico, in the province of Mechoachan: W. long. 110°, and N. lat. 19°.

## NAVIGATION.

NAVIGATION, is the art of conducting or carrying a ship from one port to another. In order to understand this science, particularly the theoretical parts of it, it is necessary that the student be acquainted with the general principles of GEOMETRY, ASTRONOMY, and TRIGONOMETRY. See these articles.

### SECT. I. Of the LOG-LINE and COMPASS.

1. THE method commonly made use of for measuring a ship's way at sea, or how far she runs in a given space of time, is by the log-line, and half-minute glass.

2. The log is a flat piece of wood, in shape like a flounder, having a piece of lead fastened to its bottom, which makes it stand or swim upright in the water: to this log is tied or fastened a long line, which is called the log-line; and this is commonly divided into certain spaces, each of which is, or ought to be, such a proportional part of a nautical mile (60 of which make a degree of a great circle on the earth) as half a minute (the time allowed for the experiment) is of an hour.

3. These spaces are called knots, because at the end of each of them there is a piece of twine with knots in it, inreeved between the strands of the line, which shews how many of these spaces or knots are run out during the half minute. They commonly begin to be counted at the distance of about 10 fathom or 60 feet from the log; that so the log, when it is hove over board, may be out of the eddy of the ship's wake before they begin to count; and for the more ready discovery of this point of commencement, there is commonly fastened at it a piece of red rag.

4. The log being thus prepared, and hove over board from the poop, and the line veered out (by the help of a reel, that turns easily, and about which it is wound) as fast as the log will carry it away, or rather as the ship sails from it, will shew, according to the time of veering, how far the ship has run in a given time, and consequently her rate of sailing.

5. A degree of a meridian, according to the exactest measures, contains about 69.545 English miles; and each mile by the statute being 5280 feet, therefore a degree

of a meridian will be about 367200 feet; whence the  $\frac{1}{60}$  of that, *viz.* a minute, or nautical mile, must contain 6120 standard feet; consequently, since  $\frac{1}{2}$  minute is the  $\frac{1}{120}$  part of an hour, and each knot being the same part of a nautical mile, it follows, that each knot will contain the  $\frac{1}{120}$  of 6120 feet, *viz.* 51 feet.

6. Hence it is evident, that whatever number of knots the ship runs in half a minute, the same number of miles she will run in one hour, supposing her to run with the same degree of velocity during that time; and therefore it is the general way to heave the log every hour to know her rate of sailing: but if the force or direction of the wind vary, and not continue the same during the whole hour; or if there has been more sail set, or any sail handed, that so the ship has run swifter or slower in any part of the hour than she did at the time of heaving the log; then there must be an allowance made accordingly for it, and this must be according to the discretion of the artist.

7. Sometimes when the ship is before the wind, and there is a great sea setting after her, it will bring home the log, and consequently the ship will sail faster than is given by the log. In this case it is usual, if there be a very great sea, to allow one mile in ten, and less in proportion, if the sea be not so great. But for the generality, the ship's way is really greater than that given by the log; and therefore, in order to have the reckoning rather before than behind the ship, (which is the safest way,) it will be proper to make the space on the log-line between knot and knot to consist of 50 feet instead of 51.

8. If the space between knot and knot on the log-line should happen to be too great in proportion to the half-minute glass, *viz.* greater than 50 feet, then the distance given by the log will be too short; and if that space be too small, then the distance run (given by the log) will be too great; therefore to find the true distance run in either case, having measured the distance between knot and knot, we have the following proportion, *viz.*

As the true distance, 50 feet, is to the measured distance; so are the miles of distance given by the log, to the true distance in miles that the ship has run.

EXAMPLE

EXAMPLE I. Suppose a ship runs at the rate of  $6\frac{1}{2}$  knots in half a minute; but measuring the space between knot and knot, I find it to be 56 feet: Required the true distance in miles.

Making it, As 50 feet is to 56 feet, so is 6.25 knots to 7 knots; I find that the true rate of sailing is 7 miles in the hour.

EXAMPLE II. Suppose a ship runs at the rate of  $6\frac{1}{2}$  knots in half a minute; but measuring the space between knot and knot, I find it to be only 44 feet: Required the true rate of sailing.

Making it, As 50 feet is to 44 feet, so is 6.5 knots to 5.72 knots; I find that the true rate of sailing is 5.72 miles in the hour.

9. Again, supposing the distance between knot and knot on the log-line to be exactly 50 feet, but that the glass is not 30 seconds; then, if the glass require longer time to run than 30 seconds, the distance given will be too great, if estimated by allowing 1 mile for every knot run in the time the glass runs; and, on the contrary, if the glass requires less time to run than 30 seconds, it will give the distance sailed too small. Consequently, to find the true distance in either case, we must measure the time the glass requires to run out (by the method in the following article;) then we have the following proportion, *viz.*

As the number of seconds the glass runs, is to half a minute, or 30 seconds; so is the distance given by the log, to the true distance.

EXAMPLE I. Suppose a ship runs at the rate of  $7\frac{1}{2}$  knots in the time the glass runs; but measuring the glass, I find it runs 34 seconds: Required the true distance sailed.

Making it, As 34 seconds is to 30 seconds, so is 7.5 to 6.6; I find that the ship sails at the rate of 6.6 miles an hour.

EXAMPLE II. Suppose a ship runs at the rate of  $6\frac{1}{2}$  knots; but measuring the glass, I find it runs only 25 seconds: Required the true rate of sailing.

Making it, As 25 seconds is to 30 seconds, so is 6.5 knots to 7.8 knots; I find that the true rate of sailing is 7.8 miles an hour.

10. In order to know how many seconds the glass runs, you may try it by a watch or clock, that vibrates seconds; but if neither of these be at hand, then take a line, and to the one end fastening a plummet, hang the other upon a nail or peg, so as the distance from the peg to the centre of the plummet be  $39\frac{1}{2}$  inches: Then this put into motion will vibrate seconds; *i. e.* every time it passes the perpendicular, you are to count one second; consequently, by observing the number of vibrations that it makes during the time the glass is running, we know how many seconds the glass runs.

11. If there be an error both in the log line and half-minute glass, *viz.* if the distance between knot and knot and the log-line be either greater or less than 50 feet, and the glass runs either more or less than 30 seconds; then the finding out the ship's true distance will be somewhat more complicate, and admit of three cases, *viz.*

CASE I. If the glass runs more than 30 seconds, and the distance between knot and knot be less than 50 feet, then the distance give by the log-line, *viz.* by allowing

1 mile for each knot the ship sails while the glass is running, will always be greater than the true distance, since either of these errors give the distance too great. Consequently, to find the true rate of sailing in this case, we must first find (by Art. 8.) the distance, on the supposition that the log-line is only wrong, and then with this (by Art. 9.) we shall find the true distance.

EXAMPLE. Suppose a ship is found to run at the rate of 6 knots; but examining the glass, I find it runs 35 seconds; and measuring the log-line, I find the distance between knot and knot to be but 46 feet: Required the true distance run.

First, (by Art. 8.) We have the following proportion, *viz.* As 50 feet: 46 feet :: 6 knots: 5.52 knots. Then (by Art. 9.) As 35 seconds: 30 seconds :: 5.52 knots: 4.73 knots. Consequently the true rate of sailing is 4.73 miles an hour.

CASE II. If the glass be less than 30 seconds, and the place between knot and knot be more than 50 feet; then the distance given by the log will always be less than the true distance, since either of these errors lessen the true distance.

EXAMPLE. Suppose a ship is found to run at the rate of 7 knots; but examining the glass, I find it runs only 25 seconds; and measuring the space between knot and knot on the log line, I find it is 54 feet: Required the true rate of sailing.

First, (by Art. 9.) As 25 seconds: 30 seconds :: 7 knots: 8.4 knots. Then (by Art. 8.) As 50 feet: 54 feet :: 8.4 knots: 9.072 knots. Consequently the true rate of sailing is 9.072 miles an hour.

CASE III. If the glass runs more than 30 seconds, and the space between knot and knot be greater than 50 feet; or if the glass runs less than 30 seconds, and the space between knot and knot be less than 50 feet: then, since in either of these two cases the effects of the errors are contrary, it is plain the distance will sometimes be too great, and sometimes too little, according as the greater quantity of the error lies; as will be evident from the following examples.

EXAMPLE I. Suppose a ship is found to run at the rate of  $9\frac{1}{2}$  knots per glass; but examining the glass, it is found to run 36 seconds; and by measuring the space between knot and knot, it is found to be 58 feet: Required the true rate of sailing.

First, (by Art. 8.) As 50 feet: 58 feet :: 9.5 knots: 11.02 knots. Then (by Art. 9.) As 38 seconds: 30 seconds :: 11.02 knots: 8.7 knots. Consequently the ship's true rate of sailing is 8.7 miles an hour.

EXAMPLE II. Suppose a ship runs at the rate of 6 knots per glass; but examining the glass, it is found to run only 20 seconds; and by measuring the log-line, the distance between knot and knot is found to be but 38 feet: Required the true rate of sailing.

First, (by Art. 8.) As 50 feet: 38 feet :: 6 knots: 4.56 knots. Then (by Art. 9.) As 20 seconds: 30 seconds :: 4.56 knots: 6.84 knots. Consequently the true rate of sailing is 6.83 miles an hour.

But if in this case it happen, that the time the glass takes, to run be to the distance between knot and knot, as 30, the seconds in half a minute, is to 50, the true distance

distance between knot and knot; then it is plain, that whatever number of seconds the glass consists of, and whatever number of feet is contained between knot and knot; yet the distance given by the log-line, will be the true distance in miles.

12. Though the method of measuring the ship's way by the log-line, described in the foregoing articles, be that which is now commonly made use of; yet it is subject to several errors, and these very considerable. For first, the half-minute or quarter-minute glasses (by which, and the log, the ship's way is determined) are seldom or never true, because dry and wet weather have a great influence on them; so that at one time they may run more, and at another time fewer than 30 seconds, and it is evident that a small error in the glass will cause a sensible one in the ship's way. Again, the chief property of the log is to have it swim upright, or perpendicular to the horizon: but this is too often wanting in logs, because few seamen examine whether it is so or not, and generally take it upon trust, being satisfied if it weigh a little more at the stern than the head: and from this there flows an error in the reckoning; for if the log does not swim upright, it will not hold water, nor remain steady in the place where it is heaved, since the least check in the hand in veering the line will make it come up several feet: this repeated will make the errors become fathoms, and perhaps knots, which, how insignificant soever they appear, are miles and parts of miles, and amount to a good deal in a long voyage. Another inconvenience attending the log-line is its stretching and shrinking; for when a new line is first used, let it be ever so well stretched upon the deck, and measured as true as possible, yet after wetting it shrinks considerably; and consequently to be the better assured of the ship's way by the log-line, we ought to measure and alter the knots on it every time before we use it; but this is seldom done oftner than once a week, and sometimes not above once or twice in a whole voyage; also when the line is measured to its greatest degree of shrinking, it is generally left there; and when, by much use, it comes to stretch again, it is seldom or never mended, though it will stretch beyond what it first shrunk. These, and many other errors, too well known, attending that method of measuring the ship's way by the log-line, plainly answers for a great many errors committed in reckonings. So it is to be wished, that either this method were improved or amended, or that some other method less subject to error were found out.

13. The meridian and prime vertical of any place cuts the horizon in 4 points, at 90 degrees distance from one another, viz. *North, South, East, and West*; that part of the *meridian* which extends itself from the place to the *north* point of the horizon is called the *north line*; that which tends to the *south* point of the horizon, is called the *south line*; and that part of the *prime vertical* which extends towards the right hand of the observer, when his face is turned to the *north*, is called the *east line*; and lastly, that part of the *prime vertical* which tends towards the left hand, is called the *west line*; the four points in which these lines meet the horizon, are called the *cardinal points*.

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14. In order to determine the course of the winds, and to discover their various alterations or shiftings; each quadrant of the horizon intercepted between the meridian and prime vertical, is usually divided into eight equal parts, and consequently the whole horizon into thirty-two; and the lines drawn from the place on which the observer standeth, to the points of division in his horizon, are called *rumb lines*, the four principal of which are those described in the preceding article, each of them having its name from the cardinal point in the horizon towards which it tends; the rest of the *rumb lines* have their names compounded of the principal lines on each side of them, as in the figure; (see *Navigation Plates*, No. 1.) and over which-soever of these lines the course of the wind is directed, that wind takes its name accordingly.

15. The instrument commonly used at sea for directing the ship's way, is called the mariner's compass; which consists of a card and two boxes. The card is a circle made to represent the horizon, whose circumference is quartered and divided into degrees, and also into thirty-two equal parts, by lines drawn from the centre to the several points of division, called points of the compass. On the back side of the card, and just below the south and north line, is fixed a steel needle with a brass cupola, or hollow center in the middle, which is placed upon the end of a fine pin, upon which the card may easily turn about; the needle is touched with a load stone, by which a certain virtue is infused into it, that makes it (and consequently the south and north line on the card above it) hang nearly in the plane of the meridian, by which means the south and north lines on the card produced would meet the horizon in the south and north points; and consequently all the other lines on the card produced would meet the horizon in the respective points.

16. The card is represented in No. 1. in which you may observe, that the capital letters N, S, E, W, denote the four cardinal points, viz. N the *North*, S the *South*, &c. and the small letter b signifies the word *by*: the *Rhomb* in the middle between any two of the cardinals are expressed by the letters denoting these cardinals, that which denotes the point lying in the meridian having the precedence; thus the rhomb in the middle between the north and east is expressed N E, which is to be read *North-East*; also S W denotes the *South-West* rhomb, &c. the other rhombs are expressed according to their situation with respect to these middle rhombs, and the nearest cardinals, as is plain from the foresaid figure.

17. The card is put into a round box, made for it, having a pin erected in the middle, upon which the hollow centre of the needle is fixed, so as the card may lie horizontal, and easily vibrate according to the motion of the needle: the box is covered over with a smooth glass, and is hung in a brass hoop upon two cylindrical pins, diametrically opposite to one another; and this hoop is hung within another brass circle, upon two pins at right angles with the former. These two circles, and the box, are placed in another square wooden box, so that the innermost box, and consequently the card, may keep horizontal which way soever the ship heels.

18. Since the meridians do all meet at the poles, and  
there

4 Z

there



greater than 45 degrees, and so the difference of latitude will be greater than the departure; but if the course be greater than 4 points, then the difference of latitude will be less than the departure; and lastly, if the course be just 4 points, the difference of latitude will be equal to the departure.

5. Since the distance, difference of latitude, and departure, form a right-angled triangle, in which the oblique angle opposite to the departure is the course, and the other its complement; therefore, having any two of these given, we can (by plain trigonometry) find the rest; and hence arise the cases of plain-sailing, which are as follow.

CASE I. Course and distance given, to find difference of latitude and departure.

EXAMPLE. Suppose a ship sails from the latitude of 30° 25' north, NNE, 32 miles, (No. 4.) Required the difference of latitude and departure, and the latitude come to. Then (by right angle trigonometry,) we have the following analogy, for finding the departure, viz.

As radius	—	—	—	10.00000
to the distance AC	—	32	—	1.50515
so is the sine of the course A 22° 30'	—	—	—	9.58284
to the departure BC	—	—	12.25	1.08709

so the ship has made 12.25 miles of departure easterly, or has got so far to the eastward of her meridian. Then for the difference of latitude or northing the ship has made, we have (by rectangular trigonometry) the following analogy, viz.

As radius	—	—	—	10.00000
is to the distance AC	—	32	—	1.50515
so is the co sine of course A	—	22° 30'	—	9.96562
to the difference of lat. AB	—	29.57	—	1.47077

so the ship has differed her latitude, or made of northing, 29.57 minutes.

And since her former latitude was north, and her difference of latitude also north; therefore,  
To the latitude sailed from — — 30°, 25' N  
add the difference of latitude — — 00°, 29 57

and the sum is the latitude come to 30°, 54.57 N

By this case are calculated the tables of difference of latitude, and departure, to every degree, point, and quarter-point of the compass.

CASE II. Course and difference of latitude given, to find distance and departure

EXAMPLE. Suppose a ship, in the latitude of 45° 25' north, sails NE½N  $\frac{1}{2}$  easterly (No 5.) till she come to the latitude of 46° 55' north. Required the distance and departure made good upon that course.

Since both latitudes are northerly, and the course also northerly; therefore,

From the latitude come to	—	—	—	46°, 55'
subtract the latitude sailed from	—	—	—	45°, 25'
and their remains	—	—	—	01°, 30'

the difference of latitude, equal to 90 miles.

And (by rectangular trigonometry) we have the following analogy, for finding the departure BD, viz.

As radius	—	—	—	10.00000
is to the diff. of latitude AB	—	90	—	1.95424

so is the tangent of course A	—	39°, 22'	—	9.91404
to the departure BD	—	—	—	73 84 1.86828

so the ship has got 73 84 miles to the eastward of her former meridian.

Again, for the distance AD, we have (by rectangular trigonometry) the following proportion, viz.

As radius	—	—	—	10.00000
is to the secant of the course	—	39°, 22'	—	10.11176
so is the difference of latitude AB	—	90	—	1.95424
to the distance AD	—	—	116.4	2.06600

CASE III. Difference of latitude and distance given, to find course and departure.

EXAMPLE. Suppose a ship sails from the latitude of 56° 50' north, on a rhomb between south and west, 126 miles, and she is then found by observation to be in the latitude of 55° 40' north. Required the course she sailed on, and her departure from the meridian. No 6.

Since the latitudes are both north, and the ship sailing towards the equator; therefore,

From the latitude sailed from	—	—	—	56° 50'
subtract the observed latitude	—	—	—	55° 10'

and the remainder — — — — 01°, 40' equal to 70 miles, is the difference of latitude.

By rectangular trigonometry we have the following proportion for finding the angle of the course F, viz.

As the distance sailed DF	—	126	—	2.10037
is to radius	—	—	—	10.00000
so is the diff. of latitude FD	—	70	—	1.84510

to the co-sine of the course F 56°, 15' 9.74473 which, because she sails between south and west, will be south 56° 15' west, or SW½W. Then, for the departure, we have (by rectangular trigonometry) the following proportion, viz.

As radius	—	—	—	10.00000
is to the distance sailed DF	—	126	—	2.10037
so is the sine of the course F	—	56°, 15'	—	9.91985
to the departure DE	—	—	104 8	2.02022

consequently she has made 104.8 miles of departure westerly.

CASE IV. Difference of latitude and departure given, to find course and distance.

EXAMPLE. Suppose a ship sails from the latitude of 44° 50' north, between south and east, till she has made 64 miles of easting, and is then found by observation to be in the latitude of 42° 56' north. Required the course and distance made good.

Since the latitudes are both north, and the ship sailing towards the equator; therefore,

From the latitude sailed from	—	—	—	44°, 50' N
take the latitude come to	—	—	—	42°, 56'

and their remains — — — — 01°, 54' equal to 114 miles, the difference of latitude or southing.

In this case by (rectangular trigonometry) we have the following proportion to find the course KGL (No. 7.) viz.

As the diff. of latitude GK	—	114	—	2.05690
is to radius	—	—	—	10.00000
so is the departure KL	—	64	—	1.80618

to the tangent of course  $G = 29^\circ, 19' - 9.74928$  which, because the ship is sailing between south and east, will be south  $29^\circ 19'$  east, or SSE  $\frac{1}{2}$  east nearly.

Then for the distance, we shall have (by rectangular trigonometry) the following analogy, *viz.*

As radius	—	—	10.00000
is to the diff. of latitude GK	114	—	2.05690
so is the secant of the course	$29^\circ, 19'$	—	10.05952
to the distance GL	—	130.8	— 2.11642

consequently the ship has sailed on a SSE  $\frac{1}{2}$  east course 130 8 miles.

CASE V. Distance and departure given, to find course and difference of latitude.

EXAMPLE. Suppose a ship at sea sails from the latitude of  $34^\circ 24'$  north, between north and west 124 miles, and is found to have made of westing 86 miles. Required the course steered, and the difference of latitude or northing made good.

In this case (by rectangular trigonometry) we have the following proportion for finding the course ADB, (No. 8.) *viz.*

As the distance AD	—	124	—	2.09342
is to radius	—	—	—	10.00000
so is the departure AB	—	86	—	1.93450
to the sine of the course D	$43^\circ, 54'$	—	—	9.84108

so the ship's course is north  $33^\circ 54'$  west, or NW  $\frac{1}{2}$  N  $\frac{1}{4}$  west nearly.

Then for the difference of latitude, we have (by rectangular trigonometry) the following analogy, *viz.*

As radius	—	—	—	10.00000
is to the distance AD	—	124	—	2.09342
so is the co-sine of the course	$43^\circ, 54'$	—	—	9.85766
to the diff. of latitude BD	—	89.35	—	1.95108

which is equal to 1 degree and 29 minutes nearly. Hence, to find the latitude the ship is in, since both latitudes are north, and the ship sailing from the equator; therefore,

To the latitude sailed from	—	—	$34^\circ, 24'$
add the difference of latitude	—	—	$1^\circ, 29'$
the sum is	—	—	$35^\circ, 53'$

the latitude the ship is in north.

CASE VI. Course and departure given, to find distance and difference of latitude.

EXAMPLE. Suppose a ship at sea, in the latitude of  $24^\circ 30'$  south, sails SE  $\frac{1}{2}$  S, till she has made of easting 96 miles. Required the distance and difference of latitude made good on that course.

In this case, by *Rectangular Trigonometry*, and by Case 2. we have the following proportion for finding the distance, (No. 9.) *viz.*

As the sine of the course G	$33^\circ, 45'$	—	9.74474
is to the departure HM	—	96	— 1.98227
so is radius	—	—	10.00000
to the distance GM	—	172.8	— 2.23753

Then, for the difference of latitude, we have (by rectangular trigonometry) the following analogy, *viz.*

As the tangent of course	—	$33^\circ, 45'$	— 9.82489
is to the departure HM	—	96	— 1.98227
so is radius	—	—	10.00000
to the difference of latitude GH	—	143.7	— 2.15738

equal to  $2^\circ, 24'$  nearly. Consequently, since the latitude the ship sailed from was south, and she sailing still towards the south,

To the latitude sailed from	—	—	$24^\circ, 30'$
add the difference of latitude	—	—	$2^\circ, 24'$

and the sum — — — —  $26^\circ, 54'$  is the latitude she is come to south.

6. When a ship stems several courses in 24 hours, then the reducing all these into one, and thereby finding the course and distance made good upon the whole, is commonly called the resolving of a traverse.

7. At sea they commonly begin each day's reckoning from the noon of that day, and from that time they lay down all the different courses and distances stemmed by the ship till noon next day upon the log-board; then from these several courses and distances had from the compass and log line, they compute the difference of latitude and departure for each course (by *Case 1. of Plain Sailing*;) and these, together with the courses and distances, are set down in a table called the traverse table; which consists of five columns: in the first of which are placed the courses and distances; in the two next the differences of latitude belonging to these courses, according as they are north or south; and in the two last are placed the departures belonging to these courses, according as they are east or west. Then they sum up all the northings, and all the southings; and taking the difference of these, they know the difference of latitude made good by the ship in the last 24 hours, which will be north or south, according as the sum of the northings or southings is greatest: The same way, by taking the sum of all the eastings, and likewise of all the westings, and subtracting the lesser of these from the greater, the difference will be the departure made good by the ship last 24 hours, which will be east or west according as the sum of the eastings is greater or less than the sum of the westings; then from the difference of latitude and departure made good by the ship last 24 hours, found as above, they find the true course and distance made good upon the whole (by *Case 4. of Plain Sailing*), as also the course and distance to the intended port.

EXAMPLE. Suppose a ship at sea, in the latitude of  $48^\circ 24'$  north at noon any day, is bound to a port in the latitude of  $43^\circ 40'$  north, whose departure from the ship is 144 miles east; consequently the direct course and distance of the ship is SSE  $\frac{1}{2}$  east 315 miles; but by reason of the shifting of the winds she is obliged to steer the following courses till noon next day, *viz.* SE  $\frac{1}{2}$  S 56 miles, SSE 64 miles, NW  $\frac{1}{2}$  W 48 miles, S  $\frac{1}{2}$  W 54 miles, and SE  $\frac{1}{2}$  east 74 miles. Required the course and distance made good the last 24 hours, and the bearing and distance of the ship from the intended port.

The solution of this traverse depends entirely on the 1st and 4th cases of *Plain Sailing*; and first we must (by *Case 1.*) find the difference of latitude and departure for each course. Thus,

1 Course SE  $\frac{1}{2}$  S distance 56 miles.  
For departure.

As radius	—	—	10.00000
is to the distance	—	56	— 1.74819

so

fo is the sine of the course 33°, 45' — 9.74474  
 to the departure — 31.11 — 1.49293  
 For difference of latitude.

As radius — — — 10.00000  
 is to the distance — 56 — 1.74819  
 fo is the co-sine of the course 33°, 45' — 9.91985  
 to the diff. of latitude — 46.57 — 1.66804  
 2. Course SSE and distance 64 miles.  
 For departure.

As radius — — — 10.00000  
 is to the distance — 64 — 1.80618  
 fo is the sine of the course 22°, 30' — 9.58284  
 to the departure — 24.5 — 1.38902  
 For difference of latitude.

As radius — — — 10.00000  
 is to the distance — 64 — 1.80618  
 fo is the co-sine of the course 22°, 30' — 9.96562  
 to the difference of latitude 59.13 — 1.77180  
 3. Course NW½W and distance 48 miles.  
 For departure.

As radius — — — 10.00000  
 is to the distance — 48 — 1.68124  
 fo is the sine of the course 56°, 15' — 9.91985  
 to the departure — 39.91 — 1.60109  
 For difference of latitude.

As radius — — — 10.00000  
 is to the distance — 48 — 1.68124  
 fo is the co-sine of the course 56°, 15' — 9.74474  
 to the difference of latitude 26.67 — 1.42598  
 4. Course S½W west and distance 54 miles.  
 For departure.

As radius — — — 10.00000  
 is to the distance — 54 — 1.73239  
 fo is the sine of the course 16°, 52' — 9.46262  
 to the departure — 15.67 — 8.19501  
 For difference of latitude.

As radius — — — 10.00000  
 is to the distance — 54 — 1.73239  
 fo is the co-sine of the course 16°, 52' — 9.98090  
 to the difference of latitude 51.67 — 1.71329  
 5. Course SE½S east and distance 74 miles.  
 For departure.

As radius — — — 10.00000  
 is to the distance — 74 — 1.86923  
 fo is the sine of the course 39°, 22' — 9.80228  
 to the departure — 46.94 — 1.67151  
 For difference of latitude.

As radius — — — 10.00000  
 is to the distance — 74 — 1.80923  
 fo is the co-sine of the course 39°, 22' — 9.88824  
 to the difference of latitude 57.21 — 1.75747

Now these several courses and distances, together with the differences of latitude and departures deduced from them, being set down in their proper columns in the traverse table, will stand as on next column.

From that table it is plain, since the sum of the northings is 26.67, and of the southings 214.58, the difference between these, viz. 187.91, will be the southing made good by the ship the last 24 hours; also the sum of the eastings being 102.55, and of the westings 55.58, the difference 46.97 will be the easting or departure made good by the ship's

The TRAVERSE TABLE.

Courses	Distances	Diff. of Lat.			Departure
		N	S	E	
SE½S	56		46.57	31.11	
SSE	64		59.13	24.5	
NW½W	48	26.67			39.91
S½W West	54		51.67		15.67
SE½S East	74		57.21	46.94	
		26.67	214.58	102.55	55.58
			26.67	55.58	
		Diff. of Lat. 187.91			46.97 Dep.

last 24 hours; consequently, to find the true course and distance made good by the ship in that time, it will be, (by Case 4. of Plain Sailing.)

As the difference of latitude — 187.91 2.27393  
 is to radius — — — 10.00000  
 fo is the departure — — — 46.97 1.67182  
 to the tangent of the course 14°, 03' — 9.39789  
 which is S½E east nearly. Then for the distance, it will be,  
 As radius — — — 10.00000  
 is to the difference of latitude 187.91 2.27393  
 fo is the secant of the course 14°, 03' 10.01319  
 to the distance — — — 193.7 2.28712  
 consequently the ship has made good the last 24 hours, on a S½E east course, 193.7 miles: And since the ship is sailing towards the equator; therefore,  
 From the latitude sailed from — 48°, 24' N  
 take the diff. of latitude made good — 3, 08 S

there remains — — — 45, 16 N  
 the latitude the ship is in north. And because the port the ship is bound for lies in the latitude of 43° 40' north, and consequently south of the ship; therefore,  
 From the latitude the ship is in — 45°, 16' N  
 take the latitude she is bound for — 43, 40 N

and there remains — — — 1, 36  
 or 96 miles, the difference of latitude or southing the ship has to make. Again, the whole easting the ship had to make being 144 miles, and she having already made 46.97 or 47 miles of easting; therefore the departure or easting she still has to make will be 97 miles: consequently, to find the direct course and distance between the ship and the intended port, it will be (by Case 4. of Plain Sailing)

As the difference of latitude — 96 — 1.98227  
 is to radius — — — 10.00000  
 fo is the departure — — — 97 — 1.98677  
 to the tangent of the course — 45°, 19' 10.00450

And  
 As radius — — — 10.00000  
 is to the difference of latitude 96 — 1.98227  
 fo is the secant of the course 45°, 19' — 10.15293  
 to the distance — — — 136.5 — 2.13620  
 whence the true bearing and distance of the intended port is SE, 136.5 miles.

Sect. 3. Of PARALLEL SAILING.

1. SINCE the parallels of latitude do always decrease the nearer they approach the pole, it is plain a degree on any of them must be less than a degree upon the equator. Now in order to know the length of a degree on any of them, let PB (No. 10.) represent half the earth's axis, PA a quadrant of a meridian, and consequently A a point on the equator, C a point on the meridian, and CD a perpendicular from that point upon the axis, which plainly will be the sine of CP the distance of that point from the pole, or the co-sine of CA its distance from the equator; and CD will be to AB, as the sine of CP, or co-sine of CA, is to the radius. Again, if the quadrant PAB is turned round upon the axis PB, it is plain the point A will describe the circumference of the equator whose radius is AB, and any other point C upon the meridian will describe the circumference of a parallel whose radius is CD.

COR. I. Hence (because the circumference of circles are as their radii) it follows, that the circumference of any parallel is to the circumference of the equator, as the co-sine of its latitude is to radius.

COR. II. And since the wholes are as their similar parts, it will be, As the length of a degree on any parallel is to the length of a degree upon the equator, so is the co-sine of the latitude of that parallel to radius.

COR. III. Hence, as radius is to the co-sine of any latitude, so are the minutes of difference of longitude between two meridians, or their distance in miles upon the equator, to the distance of these two meridians on the parallel in miles.

COR. IV. And as the co-sine of any parallel is to radius, so is the length of any arch on that parallel (intercepted between two meridians) in miles, to the length of a similar arch on the equator, or minutes of difference of longitude.

COR. V. Also, as the co-sine of any one parallel is to the co-sine of any other parallel, so is the length of any arch on

the first, in miles, to the length of the same arch on the other in miles.

2. From what has been said, arises the solution of the several cases of parallel sailing, which are as follow.

CASE I. Given the difference of longitude between two places, both lying on the same parallel; to find the distance between those places.

EXAMPLE I. Suppose a ship in the latitude of  $54^{\circ} 20'$  north, sails directly west on that parallel till she has differed her longitude  $12^{\circ} 45'$ ; required the distance sailed on that parallel.

First, The difference of longitude reduced into minutes, or nautical miles, is  $765'$ , which is the distance between the meridian sailed from, and the meridian come to, upon the equator; then to find the distance between these meridians on the parallel of  $54^{\circ} 20'$ , or the distance sailed, it will be, by Cor. 3. of the last article,

As radius ————— 10.00000  
is to the co-sine of the lat.  $54^{\circ} 20'$  ——— 9.76572  
so are the minutes of diff. long. ——— 765 ——— 2.88366  
to the distance on the parallel ——— 446.1 ——— 2.64938

EXAMPLE II. A degree on the equator being 60 minutes or nautical miles; required the length of a degree on the parallel of  $51^{\circ} 32'$ .

By Cor. 3. of the last article, it will be  
As radius ————— 10.00000  
is to the co-sine of the latitude  $51^{\circ} 32'$  ——— 9.79383  
so are the minutes in 1 degree on the equa. 60 ——— 1.77815  
to ————— 37.32 ——— 1.57198  
the miles answering to a degree on the parallel of  $51^{\circ} 32'$

By this problem the following table is constructed, shewing the geographic miles answering to a degree on any parallel of latitude; in which you may observe, that the columns marked at the top with D.L. contain the degrees of latitude belonging to each parallel; and the adjacent columns marked at the top, Miles, contain the geographic miles answering to a degree upon these parallels.

A Table shewing how many Miles answer to a Degree of Longitude, at every Degree of Latitude.

D.L.	Miles								
1	59.99	19	56.73	37	47.92	55	34.41	73	17.54
2	59.97	20	56.38	38	47.28	56	33.55	74	16.53
3	59.92	21	56.01	39	46.62	57	32.68	75	15.52
4	59.86	22	55.63	40	45.95	58	31.79	76	14.51
5	59.77	23	55.23	41	45.28	59	30.90	77	13.50
6	59.67	24	54.81	42	44.95	60	30.00	78	12.48
7	59.56	25	54.38	43	43.88	61	29.09	79	11.45
8	59.42	26	53.93	44	43.16	62	28.17	80	10.42
9	59.26	27	53.46	45	42.43	63	27.24	81	9.38
10	59.08	28	52.97	46	51.68	64	26.30	82	8.35
11	58.89	29	52.47	47	40.92	65	25.36	83	7.32
12	58.68	30	51.96	48	40.15	66	24.41	84	6.28
13	58.46	31	51.43	49	39.36	67	23.45	85	5.23
14	58.22	32	50.88	50	38.57	68	22.48	86	4.18
15	57.95	33	50.32	51	37.76	69	21.50	87	3.14
16	57.67	34	49.74	52	36.94	70	20.52	88	2.09
17	57.37	35	49.15	53	36.11	71	19.54	89	1.05
18	57.06	36	48.54	54	35.26	72	18.55	90	0.00

Though

Though this table does only shew the miles answering to a degree of any parallel, whose latitude consists of a whole number of degrees; yet it may be made to serve for any parallel whose latitude is some number of degrees and minutes, by making the following proportion, *viz.*

As 1 degree, or 60 minutes, is to the difference between the miles answering to a degree in the next greater and next less tabular latitude than that proposed; so is the excess of the proposed latitude above the next tabular latitude, to a proportional part; which, subtracted from the miles answering to a degree of longitude in the next less tabular latitude, will give the miles answering to a degree in the proposed latitude.

EXAMPLE. Required to find the miles answering to a degree on the parallel of  $56^{\circ} 44'$ .

First, The next less parallel of latitude in the table than that proposed, is that of  $56^{\circ}$ , a degree of which (by the table) is equal to 33.55 miles; and the next greater parallel of latitude in the table, than that proposed, is that of  $57^{\circ}$ , a degree of which is (by the table) equal to 32.68 miles; the difference of these is 87, and the distance between these parallels is 1 degree or 60 minutes; also the distance between the parallel of  $56^{\circ}$ , and the proposed parallel of  $56^{\circ} 44'$ , is 44 minutes: then by the preceding proportion it will be, As 60 is to 87, so is 44 to 638, the difference between a degree on the parallel of  $56^{\circ}$  and a degree on the parallel of  $56^{\circ} 44'$ ; which therefore taken from 33.55, the miles answering to a degree on the parallel of  $56^{\circ}$ , leaves 32.912, the miles answering to a degree on the parallel of  $56^{\circ} 44'$ , as was required.

CASE II. The distance sailed in any parallel of latitude, or the distance between any two places on that parallel, being given; to find the difference of longitude.

EXAMPLE. Suppose a ship in the latitude of  $55^{\circ} 36'$  north sails directly east 685.6 miles; required how much she has differed her longitude.

By Cor. 4. Art. 1. of this section, it will be

As the co-sine of the lat.	$55^{\circ} 36'$	—	9.75202
is to radius	—	—	10.00000
so is the distance sailed	685.6	—	2.83607
to min. of diff. of long.	1213	—	3.08405

which reduced into degrees, by dividing, by 60, makes  $20^{\circ} 13'$ , the difference of longitude the ship has made.

This may also be solved by help of the foregoing table, *viz.* by finding from it the miles answering to a degree on the proposed parallel, and dividing with this the given number of miles, the quotient will be the degrees and minutes of difference of longitude required.

Thus in the last example; I find, from the foregoing table, that a degree on the parallel of  $55^{\circ} 36'$  is equal to 33.89 miles; by this I divide the proposed number of miles 685.6 and the quotient is 20.13 degrees, *i. e.*  $20^{\circ} 13'$ , the difference of longitude required.

CASE III. The difference of longitude between two places on the same parallel, and the distance between them, being given; to find the latitude of that parallel.

EXAMPLE. Suppose a ship sails on a certain parallel directly west 624 miles, and then has differed her longi-

tude  $18^{\circ} 46'$  or 1126 miles: Required the latitude of the parallel she sailed upon.

By Cor. 3. Art. 1. of this section, it will be,

As the min. of diff. long.	1126	—	3.05154
is to the distance sailed	624	—	2.79518
so is radius	—	—	10.00000
to the co sine of the lat.	$56^{\circ} 21'$	—	9.74364

consequently the latitude of the ship or parallel she sailed upon was  $56^{\circ} 21'$ .

From what has been said, may be solved the following problems.

PROB. I. Suppose two ships in the latitude of  $46^{\circ} 30'$  north, distant asunder 654 miles, sail both directly north 256 miles, and consequently are come to the latitude of  $50^{\circ} 46'$  north: Required their distance on that parallel

By Cor. 6. Art. 1. of this Section, it will be,

As the co sine of	$46^{\circ} 30'$	—	9.83781
is to the co-sine of	$50^{\circ} 46'$	—	9.80105
so is	654	—	2.81558
to	601	—	2.77882

the distance between the ships when on the parallel of  $50^{\circ} 46'$ .

PROB. II. Suppose two ships in the latitude of  $45^{\circ} 48'$  north, distant 846 miles, sail directly north till the distance between them is 624 miles: Required the latitude come to, and the distance sailed.

By Cor. 5. Art. 1. of this Section, it will be,

As their first distance	846	—	2.92737
is to their second distance	624	—	2.79518
so is the co-sine of	$45^{\circ} 48'$	—	9.84334
to the co-sine	$59^{\circ} 04'$	—	9.71115

the latitude of the parallel the ships are come to.

Consequently to find their distance sailed,

From the latitude come to	—	$59^{\circ} 04'$
subtract the latitude sailed from,	—	$45^{\circ} 48'$

and there remains	—	13, 16
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equal to 796 miles, the difference of latitude or distance sailed.

#### Sect. 4. Of MIDDLE-LATITUDE SAILING.

WHEN two places lie both on the same parallel, we shewed in the last section, how, from the difference of longitude given, to find the miles of easting or westing between them, & *e contra*. But when two places lie not on the same parallel, then their difference of longitude cannot be reduced to miles of easting or westing on the parallel of either place: for if counted on the parallel of that place that has the greatest latitude, it would be too small; and if on the parallel of that place having the least latitude, it would be too great. Hence the common way of reducing the difference of longitude between two places, lying on different parallels, to miles of easting or westing, & *e contra*, is by counting it on the middle parallel between the places, which is found by adding the latitudes of the two places together, and taking half the sum, which will be the latitude of the middle parallel required. And hence arises the solution of the following cases.

CASE I. The latitudes of two places, and their difference of longitude, given; to find the direct course and distance.

EXAMPLE,

EXAMPLE. Required the direct course and distance between the Lizard in the latitude of  $50^{\circ} 00'$  north, and longitude of  $5^{\circ} 14'$  west, and St Vincent in the latitude of  $17^{\circ} 10' N.$  and longitude of  $24 20 W.$

First, To the latitude of the Lizard —  $50^{\circ}, 00' N.$   
add the latitude of St Vincent —  $17, 10$

The sum is — —  $67, 10$   
Half the sum or latitude of }  
the middle parallel is } —  $33, 35 N.$   
Also the difference of latitude is  
equal to 1970 miles of southing. Again,  
From the longitude of St Vincent —  $24, 20 W.$   
take the longitude of the Lizard —  $05, 14$

there remains — —  $16, 06$   
equal to 1146 min. of diff. of long. west.

Then for the miles of westing, or departure, it will be,  
by *Case 1. of Parallel Sailing,*

As radius — — —  $10.00000$   
is to the co-sine of the }  
middle parallel } —  $33^{\circ} 35'$  —  $9.92069$   
fo is min. diff. of long. —  $1146$  —  $3.05918$   
to the miles of westing —  $954.7$  —  $2.97987$

And for the course it will be, by *Case 4. of Plain Sailing,*

As the diff. of lat. —  $1970$  —  $3.29447$   
is to radius — — —  $10.00000$   
fo is the departure —  $954.7$  —  $2.97987$   
to the tang. of the course  $25^{\circ}, 51'$  —  $9.68540$   
which, because it is between south and west, it will be SSW  $\frac{1}{4}$  west nearly.

For the distance, it will be, by the same case,

As radius — — —  $10.00000$   
is to the diff. of lat. —  $1970$  —  $3.29447$   
fo is the secant of the course  $25^{\circ}, 51'$   $10.04579$   
to the distance —  $2189$  —  $3.34026$   
whence the direct course and distance from the Lizard to St Vincent is SSW  $\frac{1}{4}$  W, 2189 miles.

CASE II. One latitude, course, and distance failed being given, to find the other latitude and difference of longitude.

EXAMPLE. Suppose a ship in the latitude of  $50^{\circ} 00'$  north, sails south  $50^{\circ} 06'$  west, 150 miles: Required the latitude the ship has come to, and how much she has differed her longitude.

First, For the difference of latitude, it will be, by *Case 1. of Plain Sailing,*

As radius — — —  $10.00000$   
is to the distance —  $150$  —  $2.17609$   
fo is the co sine of the course  $50^{\circ}, 06'$  —  $9.80716$   
to the diff. of latitude —  $96.22$  —  $1.98325$   
equal to  $1^{\circ}, 36'$ . And since the ship is sailing towards the equator; therefore,

From the latitude she was in — —  $50^{\circ}, 00'$   
take the diff. of latitude — — —  $1, 36$

and there remains — — —  $48, 24$   
the latitude she has come to north. Consequently the latitude of the middle parallel will be  $49^{\circ} 12'$ .

Then for departure or westing it will be, by the same case,

As radius — — —  $10.00000$   
is to the distance —  $150$  —  $2.17609$   
fo is the sine of the course  $50^{\circ} 06'$  —  $9.88489$   
to the departure —  $115.1$  —  $2.06098$

As for the difference of longitude, it will be, by *Case 2. of Plain Sailing.*

As the co sine of the middle parallel  $49^{\circ}, 12'$   $9.81519$   
is to radius — — —  $10.00000$   
fo is the departure —  $115.1$  —  $2.06098$   
to the min. diff. of longitude  $176.1$  —  $2.24579$   
equal to  $2^{\circ} 56'$ , which is the difference of longitude the ship has made westerly.

CASE III. Course and difference of latitude given; to find the distance sailed, and difference of longitude.

EXAMPLE. Suppose a ship in the latitude of  $53^{\circ} 34'$  north, sails SEBS, till by observation she is found to be in the latitude of  $51^{\circ} 12'$ , and consequently has differed her latitude  $2^{\circ} 22'$  or 142 miles: Required the distance sailed, and the difference of longitude.

First, for the departure, it will be (by *Case 2. of Plain Sailing,*)

As radius — — —  $10.00000$   
is to the diff. of latitude —  $142$  —  $2.15229$   
fo is the tang. of course —  $33^{\circ} 45'$  —  $9.82489$   
to the departure —  $94.88$  —  $1.97718$   
And for the distance it will be, by the same *Case,*

As radius — — —  $10.00000$   
is to the diff. of latitude —  $142$  —  $2.15229$   
fo is the secant of the course  $33^{\circ} 45'$  —  $10.08015$   
to the distance —  $170.8$  —  $2.23244$

Then, since the latitude failed from was  $53^{\circ} 34'$  north, and the latitude come to  $51^{\circ} 12'$  north; therefore the middle parallel will be  $52^{\circ} 23'$ ; and consequently, for the difference of longitude, it will be (by *Case 2. of Parallel Sailing*)

As the co-sine of the mid. parallel  $52^{\circ} 23'$   $9.78560$   
is to the departure — — —  $94.88$   $1.97718$   
fo is radius — — —  $10.00000$   
to min. of diff. of longitude —  $155.5$   $2.19158$   
equal to  $2^{\circ} 35'$  the difference of longitude easterly.

CASE IV. Difference of latitude and distance failed, given; to find the course and difference of longitude.

EXAMPLE. Suppose a ship in the latitude of  $43^{\circ} 26'$  north, sails between south and east, 246 miles, and then is found by observation to be in the latitude of  $41^{\circ} 06'$  north: Required the direct course and difference of longitude.

First, For the course, it will be, by *Case 3. of Plain Sailing.*

As the distance — — —  $246$  —  $2.39094$   
is to radius — — —  $10.00000$   
fo is the diff. of latitude —  $140$  —  $2.14613$   
to the co-sine of the course  $55^{\circ} 19'$  —  $9.75519$   
which, because the ship sails between south and east, will be south  $55^{\circ} 19'$  east, or SEBE nearly.

Then for departure, it will be, by the same *Case,*  
As radius — — —  $10.00000$   
is to the distance —  $246$  —  $2.39094$

So is the sine of the course 55° 19' — 9.91504  
 to the departure — 202.3 — 2.30598  
 Lastly, For the difference of longitude, it will be, by  
*Case 2. of Parallel Sailing,*  
 As the co-sine of the mid. par. 42° 16' — 9.86924  
 is to the departure — 302.3 — 2.30598  
 so is radius — — — 10.00000  
 to min. of diff. of longitude 273.3 — 2.43674  
 equal to 4° 33', the difference of longitude easterly.

CASE V. Course and departure given, to find difference of latitude, difference of longitude, and distance sailed.

EXAMPLE. Suppose a ship in the latitude of 48° 23' north, sails SWbS, till she has made of westing 123 miles: Required the latitude come to, the difference of longitude, and the distance sailed.

First, For the distance, it will be, by *Case 6. of Plain Sailing,*

As the sine of the course — 33°, 45' — 9.74474  
 is to the departure — 123 — 2.08991  
 so is radius — — — 10.00000  
 to the distance — 221.4 — 2.34517

And for the difference of latitude it will be, by the same *Case,*

As the tang. of course — 33°, 45' — 9.82489  
 is to the departure — 123 — 2.08991  
 so is radius — — — 10.00000  
 to the diff. of latitude — 184 — 2.26502

equal to 3° 04': And since the ship is sailing towards the equator, the latitude come to will be 45° 19' north; and consequently the middle parallel will be 46° 51'.

Then to find the difference of longitude, it will be, by *Case 2. of Parallel Sailing,*

As the co-sine of mid. par. 46°, 51' — 9.83500  
 is to departure — 123 — 2.08991  
 so is radius — — — 10.00000  
 to min. of diff. of longit. — 180 — 2.25491  
 which is equal to 3° 00', the difference of longitude westerly.

CASE VI. Difference of latitude and departure given, to find course, distance, and difference of longitude.

EXAMPLE. Suppose a ship in the latitude of 46° 37' north, sails between south and east, till she has made of easting 146 miles, and is then found by observation to be in the latitude of 43° 24' north; required the course, distance, and difference of longitude.

First, By *Case 4. of Plain Sailing,* it will be for the course,

As the diff. of latitude — 193 — 2.28556  
 is to departure — 146 — 2.16137  
 so is radius — — — 10.00000  
 to the tang. of the course — 36°, 55' — 9.87581

which, because the ship is sailing between south and east, will be south 36° 55' east, or SEbS  $\frac{1}{2}$  east nearly.

For the distance, it will be, by the same *Case,*

As radius — — — 10.00000  
 is to the diff. of latitude — 193 — 2.28556  
 so is the secant of the course 36°, 55' — 10.09718  
 to the distance — 241.4 — 2.38274

Then for the difference of longitude, it will be, by *Case 2. of Parallel Sailing,*

As the sine of the course 36°, 55' — 9.87581  
 is to the distance — 241.4 — 2.38274  
 so is radius — — — 10.00000  
 to min. of diff. of longitude 221.4 — 2.34517

As the co-sine of the mid. par. 45°, 00' 9.84949  
 is to the departure — — — 146 — 2.16137  
 so is radius — — — 10.00000  
 to min. of diff. of longitude — 205 — 2.31188  
 equal to 3° 25', the difference of longitude easterly.

CASE VII. Distance and departure given, to find difference of latitude, course, and difference of longitude.

EXAMPLE. Suppose a ship in the latitude of 33° 40' north, sails between south and east 165 miles, and has then made of easting 112.5 miles; required the difference of latitude, course, and difference of longitude.

First, For the course, it will be, by *Case 5. of Plain Sailing,*

As the distance — 165 — 2.21748  
 is to radius — — — 10.00000  
 so is the departure — 102.5 — 2.05115  
 to the sine of the course 42°, 59' — 9.83367

which, because the ship sails between south and east, will be south 42° 59' east or SEbE  $\frac{1}{2}$  east nearly.

And for the difference of latitude, it will be, by the same *Case,*

As radius — — — 10.00000  
 is to the distance — 165 — 2.21748  
 so is the co sine of the course 42° 59' — 9.86436  
 to the difference of lat. — 120.7 — 2.08184

equal to 2° 00'; consequently the latitude come to will be 31° 40' north, and the latitude of the middle parallel will be 32° 40'. Hence, to find the difference of longitude, it will be, by *Case 2. of Parallel Sailing,*

As the co-sine of the mid. par. 32°, 40' — 9.92522  
 is to the departure — 112.5 — 2.05115  
 so is radius — — — 10.00000  
 to min. of diff. of long. — 133.6 — 2.12593

equal to 2° 13' nearly, the difference of longitude easterly.

CASE VIII. Difference of longitude and departure given, to find difference of latitude, course, and distance sailed.

EXAMPLE. Suppose a ship in the latitude of 50° 46' north, sails between south and west, till her difference of longitude is 3° 12', and is then found to have departed from her former meridian 126 miles; required the difference of latitude, course, and distance sailed.

First, For the latitude she has come to, it will be, by *Case 3. of Parallel Sailing,*

As min. of diff. of long. — 192 — 2.28330  
 is to departure — 126 — 2.10037  
 so is radius — — — 10.00000  
 to the co sine of the mid. par. — 48°, 59' — 9.81707

Now since the middle latitude is equal to half the sum of the two latitudes (by Art. 1. of this Sect.) and so the sum of the two latitudes equal to double the middle latitude; it follows, that if from double the middle latitude we subtract any one of the latitudes, the remainder will be the other. Hence from twice 48° 59', viz. 97° 58' taking 50° 46' the latitude sailed from, there remains 47° 12' the latitude come to; consequently the difference of latitude is 3° 34', or 214 minutes.

Then for the course, it will be, by *Case 4. of Plain Sailing,*

As diff. of lat. — — — 214 — 2.33041  
 is to the distance — 126 — 2.10037  
 so is radius — — — 10.00000  
 to the tang. of the course 36°, 55' — 9.87581

is to radius ———— 10.0000  
 so is the departure ——— 126 ——— 2.10037  
 to the tang. of the course 30°, 29' ——— 9.76996  
 which, because it is between south and west, will be south 30° 29' west, or SSW  $\frac{1}{2}$  west nearly.

And for the distance, it will be, by the same *Case*,  
 As radius ———— 10.0000  
 is to the diff. of lat. ——— 214 ——— 2.33041  
 so is the secant of the course 30°, 29' — 10.06461  
 to the distance ———— 248.4 ——— 2.39502

2 From what has been said, it will be easy to solve a traverse, by the rules of *Middle Latitude Sailing*.

EXAMPLE. Suppose a ship in the latitude of 43° 25' north, sails upon the following courses, viz. SWbS 63 miles, SSW  $\frac{1}{2}$  west 45 miles, SbE 54 miles, and SWbW 74 miles: Required the latitude the ship has come to, and how far she has differed her longitude.

First, By *Case* 2. of this *Section*. find the difference of latitude and difference of longitude belonging to each course and distance, and they will stand as in the following table.

Courses	Distances	Diff. of Lat.		Diff. of Longit.	
		N	S	E	W
SWbS	63		52.4		47.85
SSW $\frac{1}{2}$ W	45		39.7		28.62
SbE	54		53.0	13.75	
SWbW	74		41.1		81.08
					157.55
					13.75
			Diff. of Lat. 186.2		
					Diff. of Long. 143.80

Hence it is plain the ship has differed her latitude 186.2 minutes, or 3° 6' and so has come to the latitude of 40° 19' north, and has made of difference of longitude 143.8 minutes, or 2° 23' 48" westerly.

3. This method of sailing, though it be not strictly true, yet it comes very near the truth, as will be evident, by comparing an example wrought by this method with the same wrought by the method delivered in the next *Section*, which is strictly true; and it serves, without any considerable error, in runnings of 450 miles between the equator and parallel of 30 degrees, of 300 miles between that and the parallel of 60 degrees, and of 150 miles as far as there is any occasion, and consequently must be sufficiently exact for 24 hours run.

Sect. 5. Of MERCATOR'S SAILING.

1. THOUGH the meridians do all meet at the pole, and the parallels to the equator do continually decrease, and that in proportion to the co-sines of their latitudes; yet in old sea charts the meridians were drawn parallel to one another, and consequently the parallels of latitude made equal to the equator, and so a degree of longitude on any parallel as large as a degree on the equator: also in these charts the degrees of latitude were still represented (as they are in themselves) equal to each other, and to

those of the equator. By these means the degrees of longitude being increased beyond their just proportion, and the more so the nearer they approach the pole, the degrees of latitude at the same time remaining the same, it is evident places must be very erroneously marked down upon these charts with respect to their latitude and longitude, and consequently their bearing from one another very false.

2. To remedy this inconvenience, so as still to keep the meridians parallel, it is plain we must protract, or lengthen, the degrees of latitude in the same proportion as those of longitude are, that so the proportion in easting and westing may be the same with that of southing and northing, and consequently the bearings of places from one another be the same upon the chart as upon the globe itself.

Let ABD (No. 11.) be a quadrant of a meridian, A the pole, D a point on the equator, AC half the axis, B any point upon the meridian, from which draw BF perpendicular to AC, and BG perpendicular to CD; then BG will be the sine, and BF or CG the co-sine of BD the latitude of the point B; draw D the tangent and CE the secant of the arch CD. It has been demonstrated in Sect. 3. that any arch of a parallel is to the like arch of the equator as the co-sine of the latitude of that parallel is to radius. Thus any arch as a minute on the parallel described by the point B, will be to a minute on the equator as BF or CG is to CD; but since the triangles CGB CDE are similar, therefore CG will be to CD as CB is to CE, i. e. the co-sine of any parallel is to radius as radius is to the secant of the latitude of that parallel. But it has been just now shown, that the co-sine of any parallel is to radius, as the length of any arch as a minute on that parallel is to the length of the like arch on the equator: Therefore the length of any arch as a minute on any parallel, is to the length of the like arch on the equator, as radius is to the secant of the latitude of that parallel; and so the length of any arch, as a minute on the equator, is longer than the like arch of any parallel in the same proportion, as the secant of the latitude of that parallel is to radius. But since in this projection the meridians are parallel, and consequently each parallel of latitude equal to the equator, it is plain the length of any arch as a minute on any parallel, is increased beyond its just proportion, at such rate as the secant of the latitude of that parallel is greater than radius; and therefore to keep up the proportion of northing and southing to that of easting and westing, upon this chart, as it is upon the globe itself, the length of a minute upon the meridian at any parallel must also be increased beyond its just proportion at the same rate, i. e. as the secant of the latitude of that parallel is greater than radius. Thus to find the length of a minute upon the meridian at the latitude of 75 degrees, since a minute of a meridian is every where equal on the globe, and also equal to a minute upon the equator, let it be represented by unity: then making it as radius is to the secant of 75 degrees, so is unity to a fourth number, which is 3.864 nearly; and consequently, by whatever line you represent one minute on the equator of this chart, the length of one minute on the enlarged meridian

meridian at the latitude of 75 degrees, or the distance between the parallel of 75° 00' and the parallel of 75° 01', will be equal to 3 of these lines, and  $\frac{8664}{10000}$  of one of them. By making the same proportion, it will be found, that the length of a minute on the meridian of this chart at the parallel of 60°, or the distance between the parallel of 60° 00' and that of 60° 01', is equal to two of these lines: After the same manner, the length of a minute on the enlarged meridian may be found at any latitude; and consequently beginning at the equator, and computing the length of every intermediate minute between that and any parallel, the sum of all these shall be the length of a meridian intercepted between the equator and that parallel; and the distance of each degree and minute of latitude from the equator upon the meridian of this chart, computed in minutes of the equator, forms what is commonly called a table of meridional parts.

If the arch BD (No. 11.) represent the latitude of any point B, then (CD being radius) CE will be the secant of that latitude: but it has been shown above, that radius is to the secant of any latitude, as the length of a minute upon the equator is to the length of a minute on the meridian of this chart at that latitude; therefore CD is to CE, as the length of a minute on the equator is to the length of a minute upon the meridian, at the latitude of the point B. Consequently, if the radius CD be taken equal to the length of a minute upon the equator, CE, or the secant of the latitude, will be equal to the length of a minute upon the meridian at that latitude. Therefore, in general, if the length of a minute upon the equator be made radius, the length of a minute upon the enlarged meridian will be every where equal to the secant of the arch contained between it and the equator.

COR. 1. Hence it follows, since the length of every intermediate minute between the equator and any parallel, is equal to the secant of the latitude (the radius being equal to a minute upon the equator) the sum of all these lengths, or the distance of that parallel on the enlarged meridian from the equator, will be equal to the sum of all the secants, to every minute contained between it and the equator.

COR. 2. Consequently the distance between any two parallels on the same side of the equator is equal to the difference of the sums of all the secants contained between the equator and each parallel, and the distance between any two parallels on contrary sides of the equator is equal to the sum of the sums of all the secants contained between the equator and each parallel.

5. By the tables of meridional parts, which may be seen in Paton, and other writers on this subject, may be constructed the nautical chart, commonly called Mercator's chart. Thus, for example, let it be required to make a chart that shall commence at the equator, and reach to the parallel of 60 degrees, and shall contain 80 degrees of longitude.

Draw the line EQ representing the equator, (see No. 12.) then take, from any convenient line of equal parts, 4800 (the number of minutes contained in 80 degrees,) which set off from E to Q, and this will determine the breadth of the chart.

Divide the line EQ into eight equal parts, in the points

10, 20, 30, &c. each containing 10 degrees, and each of these divided into 10 equal parts will give the single degrees upon the equator; then through the points E, 10, 20, &c. drawing lines perpendicular to EQ, these shall be meridians.

From the scale of equal parts take 4527.4 (the meridional parts answering to 60 degrees,) and set that off from E to A and from Q to B, and join AB; then this line will represent the parallel of 60, and will determine the length of the chart.

Again, from the scale of equal parts take 603.1 (the meridional parts answering to 10 degrees,) and set that off from E to 10 on the line EA; and through the point 10 draw 10, 10, parallel to EQ; and this will be the parallel of 10 degrees. The same way, setting off from E on the line EA, the meridional parts answering to each degree, &c. of latitude; and through the several points drawing lines parallel to EQ, we shall have the several parallels of latitude.

If the chart does not commence from the equator, but is only to serve for a certain distance on the meridian between two given parallels on the same side of the equator; then the meridians are to be drawn as in the last example: and for the parallels of latitude you are to proceed thus, viz. from the meridional parts answering to each point of latitude in your chart, subtract the meridional parts answering to the least latitude, and set off the differences severally, from the parallel of least latitude, upon the two extreme meridians; and the lines joining these points of the meridians shall represent the several parallels upon your chart.

Thus let it be required to draw a chart that shall serve from the latitude of 20 degrees north to 60 degrees north, and that shall contain 80 degrees of longitude.

Having drawn the line DC to represent the parallel of 20 degrees (see No. 12.) and the meridians to it, as in the foregoing example; set off 663.3 (the difference between the meridional parts answering to 30 degrees, and those of 20 degrees) from D to 30, and from C to 30; then join the points 30 and 30 with a right line, and that shall be the parallel of 30. Also set off 1397.6 (the difference between the meridional parts answering to 40 degrees, and those of 20 degrees) from D to 40, and from C to 40, and joining the points 40 and 40 with a right line, that shall be the parallel of 40. And proceeding after the same way, we may draw as many of the intermediate parallels as we have occasion for.

But if the two parallels of latitude that bound the chart, are on the contrary sides of the equator; then draw a line representing the equator and meridians to it, as in the first example; and from the equator set off on each side of it the several parallels contained between it and the given parallels as above, and your chart is finished.

If Mercator's chart, constructed as above, hath its equator extended on each side of the point E 180 degrees, and if the several places on the surface of the earth be there laid down according to their latitudes and longitudes, we shall have what is commonly called Mercator's map of the earth. This map is not to be considered as a similar and just representation of the earth's surface; for in it the figures

figures of countries are distorted, especially near the poles: but since the degrees of latitude are every where increased in the same proportion as those of longitude are, the bearings between the places will be the same in this chart as on the globe; and the proportions between the latitudes, longitudes, and nautical distances, will also be the same on this chart, as on the globe itself; by which means the several cases of navigation are solved after a most easy manner, and adapted to the meanest capacities.

N. B. Here you must take notice, that in all charts, the upper part is the north side, and the lower part or bottom is the south side; also that part of it towards the right hand is the east, and that towards the left hand the west side of the chart.

6. Since, according to this projection, the meridians are parallel right lines; it is plain, that the rhombs which form always equal angles with the meridians, will be straight lines; which property renders this projection of the earth's surface much more easy and proper for use than any other.

7. This method of projecting the earth's surface upon a plane, was first invented by Mr Edward Wright, but first published by Mercator; and hence the sailing by the chart, was called Mercator's sailing.

8. In No. 13. let A and E represent two places upon Mercator's chart, AC the meridian of A, and CE the parallel of latitude passing through E; draw AE, and set off upon AC the length AB equal to the number of minutes contained in the difference of latitude between the two places, and taken from the same scale of equal parts the chart was made by, or from the equator, or any graduated parallel of the chart, and through B draw BD parallel to CE meeting AE in D. Then AC will be the enlarged difference of latitude, AB the proper difference of latitude, CE the difference of longitude, BD the departure, AE the enlarged distance, and AD the proper distance, between the two places A and E; also the angle BAD will be the course, and AE the rhomb line between them.

9. Now since in the triangle ACE, BD is parallel to one of its sides CE; it is plain the triangles ACE, ABD, will be similar, and consequently the sides proportional. Hence arise the solutions of the several cases in this sailing, which are as follow.

CASE I. The latitudes of two places given, to find the meridional or enlarged difference of latitude between them.

Of this case there are three varieties, viz. either one of the places lies on the equator, or both on the same side of it; or lastly, on different sides.

1. If one of the proposed places lies on the equator, then the meridional difference of latitude is the same with the latitude of the other place, taken from the table of meridional parts.

EXAMPLE. Required the meridional difference of latitude between St Thomas, lying on the equator, and St Antonio in the latitude of  $17^{\circ} 20'$  north. I look in the tables for the meridional parts answering to  $17^{\circ} 20'$ , and find it to be 1056.2, the enlarged difference of latitude required.

2. If the two proposed places be on the same side of

the equator, then the meridional difference of latitude is found by subtracting the meridional parts answering to the least latitude from those answering to the greatest, and the difference is that required.

EXAMPLE. Required the meridional difference of latitude between the Lizard in the latitude of  $50^{\circ} 00'$  north, and Antigua in the latitude of  $17^{\circ} 30'$  north. From the meridional parts of  $50^{\circ} 00'$  — 3474.5 subtract the meridional parts of  $17^{\circ} 30'$  — 1066.7

there remains — — 2407.8  
the meridional difference of latitude required.

3. If the places lie on different sides of the equator, then the meridional difference of latitude is found by adding together the meridional parts answering to each latitude, and the sum is that required.

EXAMPLE. Required the meridional difference of latitude between Antigua in the latitude of  $17^{\circ} 30'$  north, and Lima in Peru in the latitude of  $12^{\circ} 30'$  South.

To the merid. parts answering to  $17^{\circ} 30'$  1066.7  
add these answering to —  $12^{\circ} 30'$  — 756.1

the sum is — — 1822.8  
the meridional difference of latitude required.

CASE II. The latitudes and longitudes of two places given, to find the direct course and distance between them.

EXAMPLE. Required to find the direct course and distance between the Lizard in the latitude of  $50^{\circ} 00'$  north, and Port-Royal in Jamaica in the latitude of  $17^{\circ} 40'$ ; differing in longitude  $70^{\circ} 46'$ , Port-Royal lying so far to the westward of the Lizard.

PREPARATION.  
From the latitude of the Lizard —  $50^{\circ} 00'$   
subtract the latitude of Port-Royal —  $17, 40$

and there remains — — 32, 20  
equal to 1940 minutes, the proper difference of latitude,  
Then from the meridional parts of  $50^{\circ} 00'$  3474.5  
subtract those of — —  $17, 40$  1077.2

and there remains — — 2397.3  
the meridional or enlarged difference of longitude.

GEOMETRICALLY. Draw the line AC (No 14.) representing the meridian of the Lizard at A, and set off from A, upon that line, AE equal to 1940 (from any scale of equal parts) the proper difference of latitude, also AC equal to 2397 3 (from the same scale) the meridional or enlarged difference of latitude. Upon the point C raise CB perpendicular to AC, and make CB equal to 4246 the minutes of difference of longitude.

Join AB, and through E draw ED parallel to BC: so the case is constructed; and AD applied to the same scale of equal parts the other legs were taken from will give the direct distance, and the angle DAE measured by the line of chords will give the course.

By CALCULATION.  
For the angle of the course EAD, it will be, (by Rectangular Trigonometry,)

AC : CB :: R : T, BAC, *i. e.*  
As the meridional diff. of lat. 2397 3 — 3 37970  
is

is to the difference of long. — 4246.0 — 3.62798  
 fo is radius ————— 10.00000  
 to the tang. of the direct course 60° 33' — 10.34828  
 which, because Port Royal is southward of the Lizard,  
 and the difference of longitude westerly, will be south  
 60° 33' west, or SWbW  $\frac{1}{2}$  west nearly.

Then for the distance AD, it will be, (by rectangular  
 trigonometry)

R : AE :: Sec. A : AD, *i. e.*

As the radius ————— 10.00000  
 is to the proper diff. of lat. — 1940 — 3.28780  
 fo is the secant of the course — 60° 33' — 10.30833  
 to the distance ————— 3945.6 — 3.59613  
 consequently the direct course and distance between the  
 Lizard and Port-Royal in Jamaica, is south 60° 33',  
 3945.6 miles.

CASE III. Course and distance failed given, to find dif-  
 ference of latitude and difference of longitude.

EXAMPLE. Suppose a ship from the Lizard in the lati-  
 tude of 50° 00' north, sails south 35° 40' west 156 miles.  
 Required the latitude come to, and how much she has altered  
 her longitude.

GEOMETRICALLY. I. Draw the line BK (No. 15.)  
 representing the meridian of the Lizard at B; from B  
 draw the line BM, making with BK an angle equal to  
 35° 40', and upon this line set off BM equal to 156 the  
 given distance, and from M let fall the perpendicular MK  
 upon BK.

Then for BK the proper difference of latitude, it will  
 be, (by rectangular trigonometry,)

R : MB :: S, BMK : BK,

*i. e.* As radius ————— 10.00000  
 is to the distance ————— 156 — 2.19312  
 fo is the co-sine of the course 35° 40' — 9.90978  
 to the proper diff. of lat. 127 — 2.10290  
 equal to 2° 07'; and since the ship is sailing from a north  
 latitude towards the south, therefore the latitude come to  
 will be 47° 53' north. Hence the meridional difference  
 of latitude will be 193.4.

2. Produce BK to D, till BD be equal to 193.4;  
 through D draw DL parallel to MK, meeting DM pro-  
 duced in L; then DL will be the difference of longitude:  
 to find which by calculation, it will be, (by rectangular  
 trigonometry,)

R : BD :: T, LBD : DL,

*i. e.* As radius ————— 10.00000  
 is to the meridional diff. of lat. 193.4 — 2.28646  
 fo is the tangent of the course 35° 40' — 9.85594  
 to minutes of diff. of long. — 138.8 — 2.14240  
 equal to 2° 18' 48" the difference of longitude the ship  
 has made westerly.

CASE IV. Given course and both latitudes, *viz.* the  
 latitude failed from, and the latitude come to; to find the  
 distance failed, and the difference of longitude.

EXAMPLE. Suppose a ship in the latitude of 54° 20'  
 north, sails south 33° 45' east, until by observation she is  
 found to be in the latitude of 51° 45' north; required the  
 distance failed, and the difference of longitude.

GEOMETRICALLY. Draw AB (No. 16.) to repre-  
 sent the meridian of the ship in the first latitude, and set  
 off from A to B 155 the minutes of the proper difference of

latitude, also AG equal to 257.9 the minutes of the enlarged  
 difference of latitude. Through B and G, draw the lines  
 BC and GK perpendicular to AG; also draw AK mak-  
 ing with AG an angle of 33° 45', which will meet the two  
 former lines in the points C and K; so the case is con-  
 structed, and AC and GK may be found from the line of equal  
 parts: To find which,

By CALCULATION:

First, For the difference of longitude, it will be, (by  
 rectangular trigonometry,)

R : AG :: T, GAK : GK,

*i. e.* As radius ————— 10.00000  
 is to the enlarged diff. of lat. — 257.9 — 2.41145  
 fo is the tang. of the course — 33° 45' — 9.82489  
 to min. of diff. of longitude — 172.3 — 2.23634  
 equal to 2° 52' 18", the difference of longitude the ship  
 has made easterly.

This might also have been found, by first finding the  
 departure BC (by *Case 2. of Plain Sailing.*) and then it  
 would be

AB : BC :: AG : GK, the difference of longitude  
 required.

Then for the direct distance AC, it will be, (by rect-  
 angular trigonometry,)

R : AB :: Sec. A : AC,

*i. e.* As radius ————— 10.00000  
 is to the proper diff. of lat. — 155 — 2.19033  
 fo is the secant of the course — 33° 45' — 10.08015  
 to the direct distance — 186.4 — 2.27048  
 consequently the ship has sailed south 33° 45' east  
 186.4 miles, and has differed her longitude 2° 52' 18"  
 easterly.

CASE V. Both latitudes, and distance failed, given;  
 to find the direct course, and difference of longitude.

EXAMPLE. Suppose a ship from the latitude of 45°  
 26' north, sails between north and east 195 miles, and  
 then by observation she is found to be in the latitude of  
 48° 6' north; required the direct course and difference  
 of longitude.

GEOMETRICALLY. Draw AB (No. 17.) equal to  
 160 the proper difference of latitude, and from the point  
 B raise the perpendicular BD; then take 195 in your  
 compasses, and setting one foot of them in A, with the o-  
 ther crosses the line BD in D. Produce AB, till AC be equal  
 to 233.6 the enlarged difference of latitude. Thro'  
 C draw CK parallel to BD, meeting AD produced in K:  
 so the case is constructed; and the angle A may be mea-  
 sured by the line of chords, and CK by the line of equal  
 parts: To find which,

By CALCULATION:

First, For the angle of the course BAD it will be, (by  
 rectangular trigonometry)

AB : R :: AD : Sec. A. *i. e.*

As the proper diff. of lat. — 160 — 2.20412  
 is to radius ————— 10.00000  
 fo is the distance — 195 — 2.29003  
 to the secant of the course — 34° 52' — 10.08591  
 which, because the ship is sailing between north and  
 east, will be north 34° 52' east, or NEbN 1° 7' easterly.

Then for the difference of longitude, it will be, (by  
 rectangular trigonometry,)

R : AC :: T, A : CK.

*i. e.* As radius ————— 10.00000  
 is to the merid. diff. of lat. — 233.6 — 2.36847  
 so is the tang. of the course — 34°, 52' — 9.84307  
 to min. of diff. of longitude — 162.8 — 2.21154  
 equal to 2° 42' 48", the difference of longitude easterly.

CASE VI. One latitude, course, and difference of longitude, given; to find the other latitude, and distance failed.

EXAMPLE. Suppose a ship from the latitude of 48° 50' north, sails south 34° 40' west, till her difference of longitude is 2° 44'; required the latitude come to, and the distance failed.

GEOMETRICALLY. I. Draw AE (No. 18) to represent the meridian of the ship in the first latitude, and make the angle EAC equal to 34° 40', the angle of the course; then draw FC parallel to AE, at the distance of 164 the minutes of difference of longitude, which will meet AC in the point C. From C let fall upon AE the perpendicular CE; then AE will be the enlarged difference of latitude. To find which by *Calculation*, it will be, (by rectangular trigonometry.)

T, A : R :: CE : AE,

*i. e.* As the tang. of the course 34°, 40' — 9.83984  
 is to the radius ————— 10.00000  
 so is min. of diff. longitude — 164 — 2.21484  
 to the enlarged diff. of latitude — 237.2 — 2.37500  
 and because the ship is sailing from a north latitude south-  
 erly, therefore,

From the merid. parts of } — 48°, 50' — 3366.9  
 the latitude failed from }  
 take the merid. difference of latitude — 237.2

and there remains ————— 3129.7  
 the meridional parts of the latitude come to, *viz.* 46° 09'.

Hence for the proper difference of latitude,  
 From the latitude failed from ————— 48°, 50' N  
 take the latitude come to ————— 46 , 09 N

and there remains ————— 2 , 41  
 equal to 161, the minutes of difference of latitude.

2. Set off upon AE the length AD equal to 161 the proper difference of latitude, and through D draw DB parallel to CE: then AB will be the direct distance. To find which by *Calculation*, it will be, by rectangular trigonometry,

R : AD :: Sec. A : AB.

*i. e.* As radius ————— 10.00000  
 is to the proper diff. of latitude 161 2.20683  
 so is the secant of the course 34°, 40' 10.08488  
 to the direct distance ————— 195.8 2.29171

CASE VII. One latitude, course, and departure, given; to find the other latitude, distance failed, and difference of longitude.

EXAMPLE. Suppose a ship sails from the latitude of 54° 36' north, south 42° 33' east, until she has made of departure 116 miles. Required the latitude she is in, her direct distance failed, and how much she has altered her longitude.

GEOMETRICALLY. I. Having drawn the meridian AB, (No. 19.) make the angle BAD equal to 42° 33'. Draw FD parallel to AB at the distance of 116, which will meet AD in D. Let fall upon AB the perpendicular DB. Then AB will be the proper difference of latitude, and AD the direct distance: To find which by calculation, first, for the distance AD it will be, (by rectangular trigonometry)

S, A : BD :: R : AD.

*i. e.* As the sine of the course 42°, 33' 9.83010  
 is to the departure ————— 116 2.06446  
 so is radius ————— 10.00000  
 to the direct distance ————— 171.5 2.23436

Then for the proper difference of latitude, it will be, by rectangular trigonometry.

T, A : BD :: R : AB.

*i. e.* As the tang. of the course 42°, 33' 9.96281  
 is to the departure ————— 116 2.06446  
 so is radius ————— 10.00000  
 to the proper difference of latitude 126.4 2.10165  
 equal to 2° 6': consequently the ship has come to the latitude of 52° 30' north, and so the meridional difference of latitude will be 212.2.

2. Produce AB to E, till AE be equal to 212.2; and through E draw EC parallel to BD, meeting AD produced in C; then EC will be the difference of longitude; to find which by calculation, it will be, (by rectangular trigonometry)

R : AE :: T, A : EC.

*i. e.* As radius ————— 10.00000  
 is to the merid. diff. of latitude 212.2 2.32675  
 so is the tang. of the course 42°, 33' 9.96281  
 to the min. of diff. of longitude 194.8 2.28956  
 equal to 3° 14' 48", the difference of longitude easterly.

This might have been found otherwise, thus: because the triangles ACE, ADB, are similar; therefore it will be,  
 AB : BD :: AE : EC.

*i. e.* As the proper diff. of latitude 126.4 2.10165  
 is to the departure ————— 116 2.06446  
 so is the enlarged diff. of latitude 212.2 2.32675  
 to min. diff. of longitude ————— 194.8 2.28956

CASE VIII. Both latitudes and departure given, to find course, distance, and difference of longitude.

EXAMPLE. Suppose a ship from the latitude of 46° 20' N. sails between south and west, till she has made of departure 126.4 miles; and is then found by observation to be in the latitude of 43° 25' north. Required the course and distance failed, and difference of longitude.

GEOMETRICALLY. Draw AK (No. 20.) to represent the meridian of the ship in her first latitude; set off upon it AC, equal to 165, the proper difference of latitude. Draw BC perpendicular to AC, equal to 126.4 the departure, and join AB. Set off from A, AK equal to 233.3, the enlarged difference of latitude; and through K draw KD parallel to BC, meeting AB produced in D; so the case is constructed, and DK will be the difference of longitude, AB the distance, and the angle A the course; to find which

BY CALCULATION:

First, For DC the difference of longitude, it will be,  
 AC:

AC : CB :: AK : KD.

*i. e.* As the proper diff. of latitude 165 2.21748  
is to the departure — 126.4 2.10175  
so is the enlarged diff. of latitude — 233.3 2.36791  
to min. of diff. longitude — 178.7 2.25218  
equal to 2° 58' 42", the difference of longitude westerly.

Then for the course it will be, (by rectangular trigonometry,)

AC : BC :: R : T, A.

*i. e.* As the proper diff. of latitude 165 2.21748  
is to departure — 126.4 2.10175  
so is radius — 10.00000  
to the tangent of the course 37°, 27' 9.88427  
which, because the ship sails between south and west,  
will be south 37° 27' west, or SWbS 6° 30' westerly.

Lastly, For the distance AB; it will be, (by rectangular trigonometry.)

S, A : BC :: R : AB.

*i. e.* As the sine of the course 37°, 27' — 9.78395  
is to the departure — 126.4 — 2.10175  
so is radius — 10.00000  
to the direct distance — 207.9 — 2.31780

CASE IX. One latitude, distance failed, and departure given; to find the other latitude, difference of longitudes, and course.

EXAMPLE. Suppose a ship in the latitude of 48° 33' north, sails between south and east 138 miles, and has then made of departure 112.6. Required the latitude come to, the direct course, and difference of longitude.

GEOMETRICALLY. It, Draw BD (No. 21.) for the meridian of the ship at B; and parallel to it draw FE, at the distance of 112.6, the departure. Take 138, the distance, in your compasses, and fixing one point of them in B, with the other cross the line FE in the point E; then join B and E, and from E let fall upon BD the perpendicular ED; so BD will be the proper difference of latitude, and the angle B will be the course; to find which, by calculation,

First, for the course it will be, (by rectangular trigonometry,)

BE : R :: DE : S, B.

*i. e.* As the distance — 138 — 2.13988  
is to radius — 10.00000  
so is the departure — 112.6 — 2.05154  
to the sine of the course — 54° 41' 9.91166  
which, because the ship sails between south and east, will be south 54° 41' east, or SE 9° 41' easterly.

Then for the difference of latitude, it will be, (by rectangular trigonometry,)

R : BE :: Co-S, B : BD.

*i. e.* As radius — 10.00000  
is to the distance — 138 — 2.13988  
so is the co-sine of the course 54° 41' 9.76200  
to the difference of latitude 79.8 — 1.90188  
equal to 1° 10'. Consequently the ship has come to the latitude of 47° 13'. Hence the meridional difference of latitude will be 117.7.

2dly, Produce B to A, till BA be equal to 117.7; and through A draw AC parallel to DE, meeting BE produced in C; then AC will be the difference of longitude; to find which by calculation, it will be,

BD : DE :: BA : AC.

*i. e.* As the proper diff. of latitude 79.8 1.90180  
is to the departure — 112.6 2.05154  
so is the enlarged diff. of latitude 117.7 2.07078  
to the diff of longitude — 166.1 — 2.22044  
equal to 2° 46' 06", the difference of longitude easterly.

9. From what has been said, it will be easy to solve a traverse according to the rules of Mercator's sailing.

EXAMPLE. Suppose a ship at the Lizard in the latitude 50° 00' north, is bound to the Madera in the latitude of 32°, 20' north, the difference of longitude between them being 11° 40', the west end of the Madera lying so much to the westward of the Lizard, and consequently the direct course and distance (by *Case* 2. of this *Set.*) is south 26° 15' west 118.9 miles; but by reason of the winds she is forced to sail on the following courses (allowance being made for lee-way and variation, &c.) viz. SSW 44 miles, S<sup>b</sup>W ½ west 36 miles, SWbS 56 miles, and S<sup>b</sup>E 28 miles. Required the latitude the ship is in, her bearing and distance from the Lizard, and her direct course and distance from the Madera, at the end of these courses.

The geometrical construction of this traverse is performed by laying down the two ports according to construction of *Case* 2. of this *Set.* and the several courses and distances according to *Case* 3. by which we have the following solution by calculation.

1. Course SSW, distance 44 miles.

For difference of latitude:

As radius — 10.00000  
is to the distance — 44 — 1.64345  
so the is the co-sine of the course 22°, 30' 9.96562  
to the difference of latitude — 40.65 — 1.60907  
and since the course is southerly, therefore the latitude come to will be 49° 20' north, and consequently the meridional difference of latitude will be 61.8. Then

For difference of longitude,

As radius — 10.00000  
is to the enlarged diff. of lat. 61.8 — 1.79099  
so is the tang of the course 22°, 30' — 9.61722  
to min of diff. of longitude 25.6 — 1.40821

2. Course S<sup>b</sup>W ½ west, distance 36 miles.

For difference of latitude:

As radius — 10.00000  
is to the distance — 36 — 1.55630  
so is the co-sine of the course 16°, 52' 9.98090  
to the difference of latitude 34.46 1.53720  
and since the course is southerly, therefore the latitude come to will be 48° 45'. Hence the meridional difference of latitude will be 53.4. Then,

For difference of longitude:

As radius — 10.00000  
is to the enlarged diff. of lat. 53.4 — 1.72754  
so is the tan. of the course 16°, 52' 9.48171  
to the difference of longitude 16.19 — 1.20925

3. Course SWbS, distance 56 miles.

For difference of latitude:

As radius — 10.00000  
is to the distance — 56 — 1.74819  
so is the co-sine of the course 33°, 45' 9.91985

to the difference of latitude — 46 56 1.66804  
 consequently the latitude come to is 47° 59, and therefore the enlarged difference of latitude will be 69.2.

Then,

For difference of longitude :

As radius ————— 10.00000  
 is to the enlarged diff. of lat. 69.2 1.84011  
 so is the tang. of the course 33° 45' 9.82489  
 to the difference of longitude 46.24 1.66500

4. Course S $\frac{1}{2}$ E, distance 28 miles.

For difference of latitude :

As radius ————— 10.00000  
 is to the distance ————— 28 ——— 1.44716  
 so is the co-sine of the course 11°, 15' 9.99157  
 to the difference of latitude 27.46 ——— 1.43873  
 consequently the latitude come to will be 47°, 31'; and hence the meridional difference of latitude will be 43.2.

Then,

For difference of longitude :

As radius ————— 10.00000  
 is to the enlarged diff. of lat. 43.2 1.63548  
 so is the tang. of the course 11°, 15' 9.29866  
 to the diff. of longitude 8.59 0.93414

Now these several courses and distances, together with the difference of latitude and longitude belonging to each of them, being set down in their proper columns in the *Traverse Table*, will stand as follow.

Courses	Distances	Diff. of Lat.				Diff. of Longit.
		N	S	E	W	
SSW	— 44	—	40.65	—	25.6	
S $\frac{1}{2}$ W	— 36	—	34.46	—	16.19	
SW $\frac{1}{2}$ S	— 56	—	46.56	—	49.24	
S $\frac{1}{2}$ E	— 28	—	27.46	8.59	—	
		Diff of Lat.	149.13	8.59	88.03	
					8.59	
				Diff. of long.	79.44	

Hence it is plain that the ship has made of southing 149.13 minutes, and consequently has come to the latitude of 47° 31' north, and so the meridional difference of latitude between that and her first latitude will be 226.1; and since she has made of difference of longitude 79.44 minutes westerly; therefore for the direct course and distance between the lizard and the ship it will be, (by *Case 2. of this Section*.)

For the direct course :

As the merid. diff. of latitude 226.1 — 2.35430  
 is to radius ————— 10.00000  
 so is the difference of longitude 79.44 1.90004  
 to the tang. of the course — 19° 22' 9.54593  
 which because the difference of latitude is southerly, and the difference of longitude westerly, will be south 19° 22' west, or S $\frac{1}{2}$ W 8° 7' westerly. Then,

For the direct distance :

As radius ————— 10.00000

is to the proper diff. of lat 149.13 2 17349  
 so is the secant of the course 19° 22' 10.02530  
 to the direct distance — 158 — 2.19879  
 From the latitude the ship is in — 47°, 31' N  
 subtract the lat. of the Madera — 32 , 20 N

and there remains ————— 15 , 11  
 equal to 911 minutes, the proper difference of latitude between the ship and the Madera.

Again, from the merid. parts answering }  
 to the latitude the ship is in } — 3248.4  
 Take the meridional parts answering to }  
 the latitude of the Madera } — 2052.0

and there remains ————— 1196.4  
 the enlarged difference of latitude between the ship and the Madera.

Also, from the diff. of long. between }  
 the Lizard and the Madera } 11°, 40' W  
 Take the difference of long. between }  
 the Lizard and the ship } 1 , 19 $\frac{44}{100}$ W

and there remains ————— 10 , 20 $\frac{56}{100}$ W  
 equal to 620.56 min. of difference of longitude between the ship and the Madera westerly.

Then for the direct course and distance between the ship and the Madera, it will be,

For the direct course :

As the merid. diff. of latitude 1196.4 3.07788  
 is to radius ————— 10.00000  
 so is the difference of longitude 620.56 2.79278  
 to the tang. of the course — 27°, 25' 9.71493

For the direct distance :

As radius ————— 10.00000  
 is to the proper diff. of latitude 911 2.95952  
 so is the secant of the course 27°, 25' 10.05174  
 to the direct distance 1027 3.01126

10. It is very common, in working a day's reckoning at sea, to find the difference of latitude and departure to each course and distance; and adding all the departures together, and all the differences of latitudes for the whole departure, and difference of latitude made good that day, from thence (by *Case 8. of this Section*) to find the difference of longitude, &c. made good that day. Now that this method is false, will evidently appear, if we consider that the same departure reckoned on two different parallels will give unequal differences of longitude; and consequently, when several departures are compounded together and reckoned on the same parallel, the difference of longitude resulting from that cannot be the same with the sum of the differences of longitude resulting from the several departures on different parallels; and therefore we have chosen, in the last example of a *traverse*, to find the difference of longitude answering to each particular course and distance, the sum of which must be the true difference of longitude made good by the ship on these several courses and distances.

11. We shewed, at *Art. 5. of this Section*, how to construct a *Mercator's chart*; and now we shall proceed to its several uses, contained in the following problems.

PROB. 1. Let it be required to lay down a place upon

The chart, its latitude, and the difference of longitude between it and some known place upon the chart being given.

EXAMPLE. Let the known place be the Lizard lying on the parallel of  $50^{\circ} 00'$  north, and the place to be laid down St Katharines on the east coast of America, differing in longitude from the Lizard  $42^{\circ} 36'$ , lying so much to the westward of it.

Let L represent the Lizard on the chart, (see No. 12.) lying on the parallel of  $50^{\circ} 00'$  north, its meridian. Set off AE from E upon the equator EQ  $42^{\circ} 36'$ , towards Q, which will reach from E to F. Through F draw the meridian FG, and this will be the meridian of St Katharines; then set off from Q to H upon the graduated meridian QB, 28 degrees; and through H draw the parallel of latitude HM, which will meet the former meridian in K, the place upon the chart required.

PROB. II. Given two places upon the chart, to find their difference of latitude and difference of longitude.

Through the two places draw parallels of latitude; then the distance between these parallels numbered in degrees and minutes upon the graduated meridian will be the difference of latitude required; and through the two places drawing meridians, the distance between these, counted in degrees and minutes on the equator or any graduated parallel, will be the difference of longitude required.

PROB. III To find the bearing of one place from another upon the chart.

EXAMPLE. Required the bearing of St Katharines at K. (see No. 12.) from the Lizard at L.

Draw the meridian of the Lizard AE, and join K and L with the right line KL; then by the line of chords measuring the angle KLE, and with that entering the tables; we shall have the thing required.

This may also be done, by having compasses drawn on the chart (suppose at two of its corners;) then lay the edge of a ruler over the two places, and let fall a perpendicular, or take the nearest distance from the centre of the compass next the first place, to the ruler's edge; then with this distance in your compasses, slide them along by the ruler's edge, keeping one foot of them close to the ruler, and the other as near as you can judge perpendicular to it, which will describe the rhomb required.

PROB. IV. To find the distance between two given places upon the chart.

This problem admits of four cases, according to the situation of the two places with respect to one another.

CASE I. When the given places lie both upon the equator.

In this case their distance is found by converting the degrees of difference of longitude intercepted between them into minutes.

CASE II. When the two places lie both on the same meridian.

Draw the parallels of those places; and the degrees upon the graduated meridian, intercepted between those parallels, reduced to minutes, give the distance required.

CASE III. When the two places lie on the same parallel

EXAMPLE. Required to find the distance between the points K and N, (see No. 12.) both lying on the parallel

of  $28^{\circ} 00'$  north. Take from your scale the chord of  $60^{\circ}$  or radius in your compasses, and with that extent on KN as a base make the isosceles triangle KPN; then take from the line of sines the co-sine of the latitude, or sine of  $72^{\circ}$  and set that off from P to S and T. Join S and T with the right line ST, and that applied to the graduated equator will give the degrees and minutes upon it equal to the distance; which, converted into minutes, will be the distance required.

The reason of this is evident from the section of *Parallel Sailing*; for it has been there demonstrated, that radius is to the co-sine of any parallel, as the length of any arch on the equator, to the length of the same arch on that parallel. Now in this chart KN is the distance of the meridians of the two places K and N upon the equator; and since, in the triangle PKN, ST is the parallel to KN, therefore PN:PT::NK:TS. Consequently TS will be the distance of the two places K and N upon the parallel of  $28^{\circ}$ .

If the parallel the two places lie on be not far from the equator, and they not far asunder; then their distance may be found thus. Take the distance between them in your compasses, and apply that to the graduated meridian, so as the one foot may be as many minutes above, as the other is below the given parallel; and the degrees and minutes intercepted, reduced to minutes, will give the distance.

Or it may also be found thus. Take the length of a degree on the meridian at the given parallel, and turn that over on the parallel from the one place to the other, as oft as you can; then as oft as that extent is contained between the places, so many times 60 miles will be contained in the distance between them.

CASE IV. When the places differ both in longitude and latitude.

EXAMPLE. Suppose it were required to find the distance between the two places *a* and *e* upon the chart. By

PROB. II. Find the difference of latitude between them; and take that in your compasses from the graduated equator, which set off on the meridian of *a*, from *a* to *b*; then through *b* draw *bc* parallel to *de*; and taking *ac* in your compasses, apply it to the graduated equator, and it will shew the degrees and minutes contained in the distance required, which multiplied by 60 will give the miles of distance.

The reason of this is evident from *Art. 8.* of this *Sett.* for it is plain *ad* is the enlarged difference of latitude, and *ab* the proper; consequently *ae* the enlarged distance, and *ac* the proper.

PROB. V. To lay down a place upon the chart, its latitude and bearing from some known place upon the chart being known, or (which is the same) having the course and difference of latitude that a ship has made, to lay down the running of the ship, and find her place upon the chart.

EXAMPLE. A ship from the Lizard in the latitude of  $50^{\circ} 00'$  north, sails SSW till she has differed her latitude  $36^{\circ} 40'$ . Required her place upon the chart.

Count from the Lizard at L. on the graduated meridian downwards (because the course is southerly)  $36^{\circ} 40'$  to *g*;

through which draw a parallel of latitude, which will be the parallel the ship is in; then from L draw a SSW line  $Lf$ , cutting the former parallel in  $f$ , and this will be the ship's place upon the chart.

PROB. VI. One latitude, course, and distance, failed, given; to lay down the running of the ship, and find her place upon the chart.

EXAMPLE. Suppose a ship at  $a$  in the latitude of  $20^{\circ} 00'$  north, sails north  $37^{\circ} 20'$ , east 191 miles: Required the ship's place upon the chart.

Having drawn the meridian and parallel of the place  $a$ , set off the rhomb line  $ae$ , making with  $ab$  an angle of  $37^{\circ} 20'$ ; and upon it set off 191 from  $a$  to  $c$ ; through  $c$  draw the parallel  $cb$ ; and taking  $ab$  in your compasses, apply it to the graduated equator, and observe the number of degrees it contains; then count the same number of degrees on the graduated meridian from  $C$  to  $b$ , and through  $b$  draw the parallel  $be$ , which will cut  $ac$  produced in the point  $e$ , the ship's place required.

PROB. VII. Both latitudes and distance failed, given; to find the ship's place upon the chart.

EXAMPLE. Suppose a ship sails from  $a$ , in the latitude of  $20^{\circ} 00'$  north, between north and east 191 miles, and is then in the latitude of  $45^{\circ} 00'$  north: Required the ship's place upon the chart.

Draw  $de$  the parallel of  $45^{\circ}$ , and set off upon the meridian of  $a$  upwards,  $ab$  equal to the proper difference of latitude taken from the equator or graduated parallel. Through  $b$  draw  $bc$  parallel to  $de$ ; then with 191 in your compasses, fixing one foot of them in  $a$ , with the other cross  $bc$  in  $c$ . Join  $a$  and  $c$  with the right line  $ac$ ; which produced will meet  $de$  in  $e$ , the ship's place required.

PROB. VIII. One latitude, course and difference of longitude, given; to find the ship's place upon the chart.

EXAMPLE. Suppose a ship from the Lizard in the latitude of  $50^{\circ} 00'$  north, sails SWbW, till her difference of longitude is  $42^{\circ} 36'$ : Required the ship's place upon the chart.

Having drawn AE the meridian of the Lizard at L, count from E to F upon the equator  $42^{\circ} 36'$ ; and through F draw the meridian EG; then from L draw the SWbW line LK, and where this meets FG, as at K, will be the ship's place required.

PROB. IX. One latitude, course, and departure, given; to find the ship's place upon the chart.

EXAMPLE. Suppose a ship at  $a$  in the latitude of  $20^{\circ} 00'$  north, sails north  $37^{\circ} 20'$  east, till she has made of departure 116 miles: Required the ship's place upon the chart.

Having drawn the meridian of  $a$ , at the distance of 116, draw parallel to it the meridian  $kl$ . Draw the rhomb line  $ac$ , which will meet  $kl$  in some point  $c$ ; then through  $c$  draw the parallel  $cb$ , and  $a b$  will be the proper difference of latitude, and  $b c$  the departure. Take  $a b$  in your compasses, and apply it to the equator or graduated parallel; then observe the number of degrees it contains, and count so many on the graduated meridian from C upwards to  $b$ . Through  $b$  draw the parallel  $be$ , which will meet  $ac$  produced in some point as  $e$ , which is the ship's place upon the chart.

PROB. X. One latitude, distance, and departure, given; to find the ship's place upon the chart.

EXAMPLE. Suppose a ship at  $a$  in the latitude of  $20^{\circ} 00'$  north, sails 191 miles between north and east, and then is found to have made of departure 116 miles: Required the ship's place upon the chart.

Having drawn the meridian and parallel of the place  $a$ , set off upon the parallel  $a m$  equal to 116, and through  $m$  draw the meridian  $kl$ . Take the given distance 191 in your compasses; setting one foot of them in  $a$ , with the other cross  $kl$  in  $c$ . Join  $a c$ , and through  $c$  draw the parallel  $cb$ ; so  $cb$  will be the departure, and  $ab$  the proper difference of latitude; then proceeding with this, as in the foregoing problem, you will find the ship's place to be  $e$ .

PROB. XI. The latitude failed from, difference of latitude, and departure, given; to find the ship's place upon the chart.

EXAMPLE. Suppose a ship from  $a$  in the latitude of  $20^{\circ} 00'$  north, sails between north and east, till she be in the latitude of  $45^{\circ} 00'$  north, and is then found to have made of departure 116 miles: Required the ship's place upon the chart.

Having drawn the meridian of  $a$ , set off upon it, from  $a$  to  $b$ , 25 degrees, (taken from the equator or graduated parallel,) the proper difference of latitude; then through  $b$  draw the parallel  $bc$ , and make  $bc$  equal to 116 the departure, and join  $a c$ . Count from the parallel of  $a$  on the graduated meridian upwards to  $b$  25 degrees, and through  $b$  draw the parallel  $be$ , which will meet  $ac$  produced in some point  $e$ , and this will be the place of the ship required.

12. In the section of *Plain Sailing* it is plain that the terms *meridional distance*, *departure*, and *difference of longitude*, were synonymous, constantly signifying the same thing; which evidently followed from the supposition of the earth's surface being projected on a plane, in which the meridians were made parallel, and the degrees of latitude equal to one another and to those of the equator. But since it has been demonstrated (in this section) that if, in the projection of the earth's surface upon a plane, the meridians be made parallel, the degrees of latitude must be unequal, still increasing the nearer they come to the pole. It follows that these terms must denote lines really different from one another.

#### Sect. 6. Of OBLIQUE SAILING.

THE questions that may be proposed on this head being innumerable, we shall only give a few of the most useful.

PROB. I. Coasting along the shore, I saw a cape bear from me NNE; then I stood away NWbW 20 miles, and I observed the same cape to bear from me NEbE. Required the distance of the ship from the cape at each station.

GEOMETRICALLY. Draw the circle NWSE (No. 22.) to represent the compass, NS the meridian, and WE the east and west line, and let C be the place of the ship in her first station; then from C set off upon the NWbW line, CA 20 miles, and A will be the place of the ship in her second station.

From

From C draw the NNE line CB, and from A draw AB parallel to the NE½E line CD, which will meet CB in B the place of the cape, and CB will be the distance of it from the ship in its first station, and AB the distance in the second: to find which,

By CALCULATION;

In the triangle ABC are given AC, equal to 20 miles; the angle ACB, equal to 78° 45', the distance between the NNE and NW½W lines; also the angle ABC, equal to BCD, equal to 33° 45', the distance between the NNE and NE½E lines; and consequently the angle A, equal to 67° 30'.

Hence for CB, the distance of the cape from the ship in her first station, it will be (by oblique trigonometry)

$$S. ABC : AC :: S. BAC : CB,$$

*i. e.* As the sine of the angle B 33° 45' 9.74473  
is to the distance run AC — 20 — 1.30103  
so is the sine of BAC — 67, 30 9.96562  
to CB — — 33.26 1.52191

the distance of the cape from the ship at the first station.

Then for AB, it will be, by oblique trigonometry,

$$S. ABC : AC :: S. ACB : AB.$$

*i. e.* As the sine of B — 33°, 45' 9.74474  
is to AC — — 20 — 1.30103  
so is the sine of C — — 78 - 45 9.99157  
to AB — — 35.31 1.54786  
the distance of the ship from the cape at her second station.

PROB. II. Coasting along the shore, I saw two headlands; the first bore from me NE½E 17 miles, the other SSW miles. Required the bearing and distance of these headlands from one another.

GEOMETRICALLY. Having drawn the compass NWSE (No. 23.) let C represent the place of the ship; set off upon the NE½E line CA 17 miles from C to A, and upon the SSW line CB 20 miles from C to B, and join AB: then A will be the first headland, and B the second; also AB will be their distance, and the angle A will be the bearing from the NE½N line: to find which

By CALCULATION;

In the triangle ACB are given, AC 17, CB 20, and the angle ACB equal to 101° 15', the distance between the NE½E and SSW lines. Hence (by oblique angular trigonometry) it will be

As the sum of the sides AC and CB 37 1.56820  
is to their difference — 3 0.47712  
so is the tang. of ½ the sum } 39°, 22½ 9.91417  
of the angles A and B }  
to the tang. of half their diff. 3, 49 8.82309  
consequently the angle A will be 43° 11', and the angle B 35° 34'; also the bearing of B from A will be S½W 1° 49' westerly, and the bearing of A from B will be N½E 1° 49' easterly.

Then for the distance AB, it will be, by oblique-angular trigonometry,

$$S. A : CB :: S. C : AB.$$

*i. e.* As the sine of A 43°, 11' 9.83527  
is to CB — 20 — 1.30103  
so is the sine of C — 101, 15 — 9.99157  
to AB — — 28.67 — 1.45733  
the distance between the two headlands.

PROB. III. Coasting along the shore, I saw two headlands; the first bore from me NW½N, and the second NNE; then standing away E½N ½ northerly 20 miles; I found the first bore from me WNW ½ westerly, and the second N½W ½ westerly. Required the bearing and distance of these two headlands.

GEOMETRICALLY. Having drawn the compass NWSE (No. 24.) let C represent the first place of the ship; from which draw the NW½N line CB, and the NNE line CD, also the E½N ½ N line CA, which make equal to 20. From A draw AB parallel to the WNW ½ W line, and AD parallel to the N½W ½ W meeting the two first lines in the points B and D; then B will be the first and D the second headlands. Join the points B and D, and BD will be the distance between them, and the angle CDB the bearing from the NNE line: to find which

By CALCULATION;

1. In the triangle ABC are given the angle BCA, equal to 104° 04', the distance between the NW½N line, and the ENE½E line; the angle BAC, equal to 36° 34', the distance between the WSW½W line and the WNW½W line; the angle ABC equal to 39° 22', the distance between the ESE½E line; and the SW½S line, also the side CA equal to 20 miles; whence for CB, it will be (by oblique trigonometry)

As the sine of CBA — 39°, 22' — 9.80228  
is to AC — — 20 — 1.30103  
so is the sine of CAB — 36°, 34' — 9.77507  
to CB — — 18.79 — 1.27382

the distance between the first headland and the ship in her first station.

2. In the triangle ACD, are given the angle ACD, equal to 47° 49', the distance between the ENE½E line, and the NNE line; the angle CAD, equal to 92° 49', the distance between the WSW½W line; and the N½W½W line, the angle CDA equal to 39° 22', the distance between the SSW line and the S½E½E line; also the leg CA equal to 20.

Hence for CD, it will be (by oblique trigonometry)  
As the sine CAD — 39°, 22' — 9.80228  
is to AC — — 20 — 1.30103  
so is the sine of CAD — 92°, 34' — 9.99960  
to CD — — 31.5 — 1.49835  
the distance between the second headland and the ship in her first station.

3. In the triangle BCD are given BC 18.79, CD 31.5, and the angle BCD equal to 56° 15', the distance between the NW½N line and the NNE line.

Hence for the angle CDB, it will be (by oblique trigonometry)

As the sum of the sides — 50.29 — 1.70148  
is to the difference of sides 12.71 — 1.10415  
so is tangent of ½ sum } — 61°, 51' — 10.27189  
of the unknown angles }

to tang. of half their diff. 25, 18 — 9.67458  
consequently the angle CBD is 87° 10', and the angle CDB 36° 35'. Hence the bearing of the first headland from the second will be S 59° 8' W or SW½W½W nearly; and for the distance between them, it will be,

As the sine of BDC — 36°, 35' — 9.77524  
is to BC — — 18.79 — 1.27382

so is the sine of  $\angle BCD$  —  $56^\circ, 15'$  — 9.91985  
 to  $BD$  — — — — — 26 21 — 1.41843  
 the distance between the two headlands.

This, and the first problem, are of great use in drawing the plot of any harbour, or laying down any sea coast.

Suppose a ship that makes her way good within  $6\frac{1}{2}$  points of the wind, at north, is bound to a port bearing east 86 miles distance from her: Required the course and distance upon each tack, to gain the intended port.

GEOMETRICALLY. Having drawn the compass NE SW, (No. 25.) let C represent the ship's place, and set off upon the east line CA 86 miles, so A will be the intended port. Draw CD and CB on each side of the north line at  $6\frac{1}{2}$  points distance from it, and through A draw AB parallel to CD meeting CB in B; then the ENE  $\frac{1}{2}$  E line CB, will be the course of the ship upon the starboard tack, and CB its distance on that tack; also the ESE  $\frac{1}{2}$  E line Ab, will be the course on the larboard tack, and BA the distance on that tack: to find which

By CALCULATION;

In the triangle ABC are given, the angle ACB, equal to  $16^\circ, 53'$ , the distance between the east and ENE  $\frac{1}{2}$  E line; the angle CBA, equal to  $146^\circ, 14'$ , the distance between the ENE  $\frac{1}{2}$  E and the WNW  $\frac{1}{2}$  W lines; the angle BAC equal to  $16^\circ, 53'$ , the distance between the east and ESE  $\frac{1}{2}$  E lines; also AC 86 miles.

Hence since the angle at A and C are equal, the legs CB and BA will likewise be equal; to find either of which (suppose CB) it will be (by oblique angled trigonometry.)

As the sine of B	—	$146^\circ, 14'$	—	9.74493
is to AC	—	86	—	1.93450
so is the sine of A	—	$16, 53$	—	9.46303
to CB	—	44.94	—	1.65260

the distance the ship must sail on each tack.

There is a great variety of useful questions of this nature that may be proposed; but the nature of them being better understood by practice at sea, we shall leave them, and go on to *Current Sailing*.

SECT. 7. Concerning CURRENTS, and how to make proper allowances.

I. CURRENTS are certain settings of the *stream*, by which all bodies (as ships, &c.) moving therein, are compelled to alter their course or velocity, or both; and submit to the motion impressed upon them by the current.

CASE I. If the current sets just with the course of the ship, (*i. e.*) moves on the same rhomb with it; then the motion of the ship is increased, by as much as is the drift or velocity of the current.

EXAMPLE. Suppose a ship sails SEbS at the rate of 6 miles an hour, in a current that sets SEbS 2 miles an hour: Required her true rate of sailing.

Here it is evident that the ship's true rate of sailing will be 8 miles an hour.

CASE II. If the current sets directly against the ship's course, then the motion of the ship is lessened by as much as is the velocity of the current.

EXAMPLE. Suppose a ship sails SSW at the rate of 10 miles an hour, in a current that sets NNE 6 miles an hour. Required the ship's true rate of sailing.

Here it is evident that the ship's true rate of sailing will be 4 miles an hour. Hence it is plain,

COR. I. If the velocity of the current be less than the velocity of the ship, then the ship will get so much ahead as is the difference of these velocities.

COR. II. If the velocity of the current be greater than that of the ship, then the ship will fall so much a stern as is the difference of these velocities.

COR. III. Lastly, If the velocity of the current be equal to that of the ship, then the ship will stand still; the one velocity destroying the other.

CASE III. If the current thwarts the course of the ship, then it not only lessens or augments her velocity, but gives her a new direction compounded of the course she steers, and the setting of the current, as is manifest from the following

LEMMA. If a body at A (No. 26.) be impelled by two forces at the same time, the one in the direction AB capable to carry that body from A to B in a certain space of time, and the other in the direction AD capable to carry it from A to D in the same time; complete the parallelogram ABCD, and draw the diagonal AC; then the body at A agitated by these two forces together, will move along the line BC, and will be in the point C at the end of the time in which it would have moved along AD or AB with the forces separately applied.

Hence the solution of the following examples will be evident.

EXAMPLE I. Suppose a ship sails (by the compass) directly south 96 miles in 24 hours, in a current that sets east 45 miles in the same time. Required the ship's true course and distance.

GEOMETRICALLY. Draw AD (see No. 26.) to represent the south and north line of the ship at A, which make equal to 96; from D draw DC perpendicular to AD, equal to 45; and join AC. Then C will be the ship's true place, AC her true distance, and the angle CAD the true course. To find which

By CALCULATION:

First, For the true course DAC, it will be, (by rectangular trigonometry,)

As the apparent distance AD	—	96	—	1.98227
is to the current's motion DC	—	45	—	1.65321
so is radius	—	—	—	10.00000
to the tangent of the true	}	—	$25^\circ, 07'$	9.67094
course DAC				

consequently the ship's true course is S  $25^\circ, 07'$  E, or SSE  $2^\circ, 37'$ , easterly.

Then for the true distance AC, it will be, (by rectangular trigonometry,)

As the sine of the course A	—	$25^\circ, 07'$	—	9.62784
is to the departure DC	—	45	—	1.65321
so is radius	—	—	—	10.00000
to the true distance AC	—	106	—	2.02537

EXAMPLE. Suppose a ship sails SE 120 miles in 20 hours, in a current that sets WbN at the rate of 2 miles an hour: Required the ship's true course and distance sailed in that time.

GEOMETRICALLY. Having drawn the compass NESW (No 27.) let C represent the place the ship failed from; draw the SE line CA, which make equal to 120; then will A be the place the ship caped at.

From A draw AB parallel to the W&N line CD, equal to 40, the motion of the current in 20 hours, and join CB; then B will be the ship's true place at the end of 20 hours, CB her true distance, and the angle SCB her true course. To find which

By CALCULATION;

In the triangle ABC, are given CA 120, AB 40, and the angle CAB equal to 34° 45', the distance between the E&S and SE lines, to find the angles B and C, and the side CB.

First, For the angles C and B, it will be, (by oblique trigonometry)

As the sum of the sides CA and AB 160 — 2.20412  
is to their difference 80 — 1.90309  
so is the tang. of half the sum } 73°, 07' 10.51783  
of the angles B and C }  
to the tang. of half their diff. — 59, 45 10.21680  
consequently the angle B will be 131, 52, and the angle ACB 14° 23'. Hence the true course is S 30°, 37' E, or SSE 2° 07' easterly.

Then for the true distance CB, it will be, (by oblique trigonometry)

As the sine of B — 131°, 52' — 9.87198  
is to AC — 120 — 2.07918  
so is the sine of A — 33°, 45' — 9.74474  
to the true distance CB — 89.53 — 1.95194

EXAMPLE III. Suppose a ship coming out from sea in the night, has sight of Scilly light, bearing NE&N distance 4 leagues, it being then flood tide setting ENE 2 miles an hour, and the ship running after the rate of 5 miles an hour. Required upon what course and how far she must sail to hit the Lizard, which bears from Scilly E½S distance 17 leagues.

GEOMETRICALLY. Having drawn the compass NESW (No. 28.) let A represent the ship's place at sea, and draw the NE&N line AS, which make equal to 12 miles, so S will represent Scilly.

From S draw SL equal to 51 miles, and parallel to the E½S line; then L will represent the Lizard.

From L draw LC parallel to the ENE line, equal to 2 miles, and from C draw CD equal to 5 miles meeting AL in D; then from A draw AB parallel to CD meeting LC produced in B; and AB will be the required distance, and SAB the true course. To find which

By CALCULATION;

In the triangle ASL are given the side AS equal to 12 miles, the side SL equal to 51, and the angle ASL equal to 118° 07', the distance between the NE&N and W½N lines; to find the angles SAL and SLA. Consequently, (by oblique trigonometry,) it will be,

As the sum of the sides AS and SL — 63 1.79934  
is to their difference — 39 1.59106  
so is the tang. of half the sum } 30°, 56' 9.77763  
of the angles SAL and SLA }  
to the tang. of half their diff. — 20°, 21' 9.56935

consequently the angle SAL, will be 51° 17', and so the direct bearing of the Lizard from the ship will be N 85° 02' E, or E&N 6° 17' E; and for the distance AL, it will be (by oblique trigonometry,)

As the sine of SAL — 51°, 17' — 9.89223  
is to SL — 51 — 1.70757  
so is the sine of ASL — 118°, 07' — 9.94546  
to AL — 57.65 — 1.76080

the distance between the ship and the Lizard.  
Again, in the triangle DLC, are given the angle L equal to 17° 32', the distance between the ENE and N 85° 02' E lines; the side LC, equal to 2 miles, the current's drift in an hour; and the side CD, equal to 5 miles, the ship's run in the same time. Hence for the angle D, it will be (by oblique trigonometry,)

As the ship's run in 1 hour DC — 5 — 0.69897  
is to the sine of L — 17°, 32' — 9.47894  
so is the current's drift LC — 2 — 0.30103  
to the sine of D — 6°, 55' — 9.08100  
consequently since by construction the angle LAB is equal to the angle LDC, the course the ship must steer is S 88° 03' E.

Then for the distance AB, it will be (by oblique trigonometry,)

As the sine of B — 155°, 33' — 9.61689  
is to AL — 57.65 — 1.76080  
so is the sine of L — 17.32 — 9.47894  
to AB — 41.96 — 1.62285

consequently, since the ship is sailing at the rate of 5 miles an hour, it follows, that in sailing 8<sup>h</sup> 24<sup>m</sup> S 88° 03' E, she will arrive at the Lizard.

EXAMPLE IV. A ship from a certain headland in the latitude of 34° 00' north, sails SE&S 12 miles in three hours, in a current that sets between north and east; and then the same headland is found to bear WNW, and the ship to be in the latitude of 33° 52' north. Required the setting and drift of the current.

GEOMETRICALLY. Having drawn the compass NESW (No. 29.) let A represent the place of the ship, and draw the SE&S line AB equal to 12 miles, also the ESE line AC.

Set off from A upon the meridian AD, equal to 8 miles, the difference of latitude. and through D draw DC parallel to the east and west line WE, meeting AC in C. Join C and B with the right line BC; then C will be the ship's place, the angle ABC the setting of the current from the SE&S line, and the line BC will be the drift of the current in 3 hours. To find which

By CALCULATION:

In the triangle ADC right angled at D, are given the difference of latitude AD equal to 8 miles, the angle DAC equal to 67° 30'. Whence for AC, the distance the ship has sailed, it will be

As radius — 10.00000  
is to the diff. of latitude AD — 8 — 0.90309  
so is the secant of the course } DAC — 67°, 30' 10.41716  
to the distance run AC — 20.9 — 1.32025

Again, in the triangle ABC, are given AB equal to 12

12 miles, AC equal to 20.9; and the angle BAC equal to  $33^{\circ} 45'$ , the distance between the SEBS and ESE lines. Whence for the angle at B, it will be,  
 As the sum of the sides AC and AB 32.9 1.51720  
 is to their difference — 8.9 — 0.94930  
 so is the tang. of half the }  
 sum of the angles B and C }  $73^{\circ}, 07' — 10.51806$   
 to tang. of  $\frac{1}{2}$  their diff. —  $41^{\circ}, 43' \frac{1}{2} — 9.95025$   
 consequently the angle B is  $114^{\circ} 51'$ , and so the setting of the current will be N  $81^{\circ} 06'$  E or EbE  $2^{\circ} 21'$  E.  
 Then for BC the current's drift in 3 hours, it will be,  
 As the sine of B —  $114^{\circ}, 51' — 9.92700$   
 is to the distance run AC 20.9 — 1.32025  
 so is the sine of A —  $33^{\circ}, 45' — 9.74474$   
 to BC — 12.8 — 1.10719  
 the current's drift in 3 hours, and consequently the current sets EbN  $2^{\circ} 21'$  E 4.266 miles an hour.

Sect. 8. Concerning the VARIATION of the COMPASS, and how to find it from the true and observed AMPLITUDES or AZIMUTHS of the sun.

1. THE variation of the compass is how far the north or south point of the needle stands from the true south or north point of the horizon towards the east or west; or it is an arch of the horizon intercepted between the meridian of the place of observation and the magnetic meridian.

2. It is absolutely necessary to know the variation of the compass at sea, in order to correct the ship's course; for since the ship's course is directed by the compass, it is evident that if the compass be wrong the true course will differ from the observed, and consequently the whole reckoning differ from the truth.

3. The sun's true amplitude is an arch of the horizon comprehended between the true east or west point thereof, and the centre of the sun at rising or setting; or it is the number of degrees, &c. that the centre of the sun is distant from the true east or west point of the horizon, towards the south or north.

4. The sun's magnetic amplitude is the number of degrees that the centre of the sun is from the east or west point of the compass, towards the south or north point of the same at rising or setting.

5. Having the declination of the sun, together with the latitude of the place of observation, we may from thence find the sun's true amplitude, by the following astronomic proposition, viz.

As the co-sine of the latitude is to the radius  
 So is the sine of the sun's declination to the sine of the sun's true amplitude  
 which will be north or south according as the sun's declination is north or south.

EXAMPLE. Required the sun's true amplitude in the latitude of  $41^{\circ} 50'$  north, on the 23d day of April 1731.

First, I find (from the tables of the sun's declination) that the sun's declination the 23d of April is  $15^{\circ} 54'$  north; then for the true amplitude, it will be, by the former analogy.

As the co sine of the lat.  $41^{\circ} 50'$  — 9.87221  
 is to radius — — — 10.00000

so is the sine of the decl.  $15^{\circ}, 54'$  — 9.43769  
 to the sine of the amplit.  $21^{\circ}, 35'$  — 9.56548  
 which is north, because the declination is north at that time; and consequently, in the latitude of  $41^{\circ} 50'$  north, the sun rises on the 23d of April  $21^{\circ} 35'$  from the east part of the horizon towards the north, and sets so much from the west the same way.

6. The sun's true azimuth is the arch of the horizon intercepted between the meridian and the vertical circle passing through the centre of the sun at the time of observation.

7. The sun's magnetic azimuth is the arch of the horizon intercepted between the magnetic meridian and the vertical, passing through the sun.

8. Having the latitude of the place of observation, together with the sun's declination and altitude at the time of observation, we may find his true azimuth after the following method, viz.

Make it,  
 As the tangent of half the complement of the latitude is to the tangent of half the sum of the distance of the sun from the pole and complement of the altitude  
 So is the tangent of half the difference between the distance of the sun from the pole and complement of the altitude

To the tangent of a fourth arch which fourth arch added to half the complement of the latitude will give a fifth arch, and this fifth arch lessened by the complement of the latitude will give a sixth arch.  
 Then make it

As the radius is to the tangent of the altitude  
 so is the tangent of the sixth arch to the co sine of the sun's azimuth  
 which is to be counted from the south or north, to the east or west, according as the sun is situated with respect to the place of observation.

If the latitude of the place and declination of the sun be both north or both south, then the declination taken from  $90^{\circ}$  will give the sun's distance from the pole; but if the latitude and declination be on contrary sides of the equator, then the declination added to  $90^{\circ}$  will give the sun's distance from the nearest pole to the place of observation.

EXAMPLE. In the latitude of  $51^{\circ} 32'$  north, the sun having  $19^{\circ} 39'$  north declination, his altitude was found by observation to be  $38^{\circ} 18'$ : Required the azimuth.

By the first of the foregoing analogies, it will be  
 As the tangent of  $\frac{1}{2}$  the complement of the latitude }  $19^{\circ}, 14' 9.54269$   
 is to the tangent of  $\frac{1}{2}$  the sum of the distance of the sun from the pole and complement of the altitude — }  $61^{\circ}, 01 10.25655$   
 so is the tangent of half their difference — }  $9^{\circ}, 19 7.21499$

to the tang. of a 4th arch  $40^{\circ}, 20' 9.92885$   
 which fourth arch  $40^{\circ} 20'$ , added to  $19^{\circ} 14'$  half the complement of the latitude, give a fifth arch  $59^{\circ} 34'$ ; and this fifth arch lessened by  $38^{\circ} 28'$ , the complement of the latitude, gives the sixth arch  $21^{\circ} 06'$ ; then for the

the azimuth, it will be, by the second of the preceding analogies,

As radius ————— 10.00000  
 is to the tang. of the altitude 38°, 18' 9.89749  
 so is the tang. of the sixth arch 21, 06 — 9.58644  
 to the co-sine of the azimuth 72, 15 — 9.48393  
 which, because the latitude is north and the sun south of the place of observation, must be counted from the south towards the east or west; and consequently, if the altitude of the sun was taken in the morning, the azimuth will be S 72° 15' E, or ESE 4° 45' E; but if the altitude was taken in the afternoon, the azimuth will be S 72° 15' W, or WSW 4° 45' westerly.

9. Having found the sun's true amplitude or azimuth by the preceding analogies, and his magnetic amplitude or azimuth by observation, it is evident, if they agree, there is no variation; but if they disagree, then if the true and observed amplitudes at the rising or setting of the sun be both of the same name, *i. e.* either both north, or both south, their difference is the variation; but if they be of different names, *i. e.* one north and the other south, their sum is the variation. Again, if the true and observed azimuth be both of the same name, *i. e.* either both east or both west, their difference is the variation; but if they be of different names, their sum is the variation: And to know whether the variation is easterly, observe this general rule, *viz.*

Let the observer's face be turned to the sun: then if the true amplitude or azimuth be to the right hand of the observed, the variation is easterly; but if it be to the left, westerly.

To explain which, let NESW (No. 30.) represent a compass, and suppose the sun is really E $\delta$ S at the time of observation, but the observer sees him off the east point of the compass, and so the true amplitude or azimuth of the sun is to the right of the magnetic or observed; here it is evident that the E $\delta$ S point of the compass ought to lie where the east point is, and so the north where the N $\delta$ W is; consequently the north point of the compass is a point too far east, *i. e.* the variation in this case is easterly. The same will hold when the amplitude or azimuth is taken on the west side of the meridian.

Again, let the true amplitude or azimuth be to the left hand of the observed. Thus, suppose the sun is really E $\delta$ N at the time of observation, but the observer sees him off the east point of the compass, and so the true amplitude or azimuth to the left of the observed: Here it is evident that the E $\delta$ N point of the compass ought to stand where the east point is, and so the north where the N $\delta$ E point is; consequently the north point of the compass lies a point too far westerly, so in this case the variation is west. The same will hold when the sun is observed on the west side of the meridian.

EXAMPLE I. Suppose the sun's true amplitude at rising is found to be E 14° 20' N, but by the compass it is found to be E 26° 12': Required the variation, and which way it is.

Since they are both the same way, therefore  
 From the magnetic amplitude ——— E 26°, 12' N,

take the true amplitude ——— E 14, 20 N.

and there remains the variation ——— 11, 52 E.  
 which is easterly, because in this case the true amplitude is the right of the observed.

EXAMPLE II. Suppose the sun's true amplitude at setting is W 34° 26' S, and his magnetic amplitude W 23° 13' S: Required the variation, and which way it is.

Since they lie both the same way, therefore  
 From the sun's true amplitude — W 34°, 26' S.  
 take his magnetic amplitude — W 23, 13 S.

there remains the variation ——— 11, 13 W.  
 which is westerly, because the true amplitude, in this case, is to the left hand of the observed.

EXAMPLE III. Suppose the sun's true altitude at rising is found to be 13° 24' N, and his magnetic E 12° 32' S: Required the variation, and which way it lies.

Since the true and observed amplitudes lie different ways, therefore

To the true amplitude ——— E 13°, 24' N.  
 add the magnetic amplitude ——— E 12, 32 S.

the sum is the variation ——— 25, 56 W.  
 which is westerly, because the true amplitude is, in this case, to the left of the observed.

EXAMPLE IV. Suppose the sun's true altitude at setting is found to be W 8° 24' N, but his magnetic amplitude is W 10° 13' S: Required the variation.

To the true amplitude ——— W 8°, 24' N.  
 add the magnetic ——— W 10, 13 S.

the sum is the variation ——— 18, 37 E.  
 which is easterly, because the true amplitude is to the right of the observed.

EXAMPLE V. Suppose the sun's true azimuth at the time of observation, is found to be N 86° 40' E, but by the compass it is N 73° 24' E: Required the variation, and which way it lies.

From the sun's true azimuth, — N 86°, 40' E.  
 take the magnetical, ——— N 73, 24 E.

there remains the variation, ——— 13, 16 E.  
 which is easterly, because the true azimuth is to the right of the observed.

EXAMPLE VI. Suppose the sun's true azimuth is S 3° 24' E. and the magnetical S 4° 36' W: Required the variation, and which way it lies.

To the true azimuth ——— S 3°, 24' E.  
 add the magnetical azimuth ——— S 4, 36 W.

the sum is the variation ——— 8, 00 W.  
 which is westerly, because the true azimuth is, in this case, to the left of the observed.

10. The variation of the compass was first observed at London, in the year 1580, to be 11° 15' easterly, and in the year 1622 it was 6° 0' E; also in the year 1634, it was 4° 05' E, still decreasing, and the needle approaching the true meridian, till it coincided with it, and then there was no variation; after which, the variation

tion began to be westerly; and in the year 1672, it was observed to be  $2^{\circ} 30' W$ ; also in the year 1683, it was  $4^{\circ} 30' W$ ; and since that time the variation still continues at London to increase westerly; but how far it will go that way, time and observations will probably be the only means to discover.

Again, at Paris, in the year 1640, the variation was  $3^{\circ} 00' E$ ; and in the year 1666, there was no variation; but in the year 1681, it was  $2^{\circ} 30' W$ , and still continues to go westerly.

In short, from observations made in different parts of the world, it appears, that in different places the variation differs both as to its quantity and denomination, it being east in one place, and west in another; the true cause and theory of which, for want of a sufficient number of observations, has not as yet been fully explained.

SECT. 9. *The METHOD of keeping a JOURNAL at sea; and how to correct it, by making proper allowances for the leeway, variation, &c.*

1. LEE-WAY is the angle that the rhomb bline, upon which the ship endeavours to sail, makes with the rhomb she really sails upon. This is occasioned by the force of the wind or surge of the sea, when she lies to the windward, or is close hauled, which causes her to fall off and glide side-ways from the point of the compass she capes at. Thus let *NESW* (No. 31.) represent the compass; and suppose a ship at *C* capes at, or endeavours to sail upon, the rhomb *Ca*; but by the force of the wind, and surge of the sea, she is obliged to fall off, and make her way good upon the rhomb *Cb*; then the angle *aCb* is the lee-way; and if that angle be equal to one point, the ship is said to make one point lee way; and if equal to two points, the ship is said to make two points lee way, &c.

2. The quantity of this angle is very uncertain, because some ships, with the same quantity of sail, and with the same gale, will make more lee-way than others; it depending much upon the mould and trim of the ship, and the quantity of water that she draws. The common allowances that are generally made for the lee-way, are as follow.

1. If a ship be close hauled, has all her sails set, the water smooth, and a moderate gale of wind, she is then supposed to make little or no lee-way.

2. If it blow so fresh as to cause the small sails be handed, it is usual to allow one point.

3. If it blow so hard that the top sails must be close reefed, then the common allowance is two points for lee-way.

4. If one top sail must be handed, then the ship is supposed to make between two and three points lee way.

5. When both top-sails must be handed, then the allowance is about four points for lee-way.

6. If blows so hard, as to occasion the fore-course to be handed, the allowance is between  $5\frac{1}{2}$  and 6 points.

7. When both main and fore-courses must be handed, then 6 or  $6\frac{1}{2}$  points are commonly allowed for lee-way.

8. When the mizen is handed, and the ship is trying a hull, she is then commonly allowed about 7 points for lee-way.

3 Though these rules are such as are generally made

use of, yet since the lee-way depends much upon the mould and trim of the ship, it is evident that they cannot exactly serve to every ship; and therefore the best way is to find it by observation: Thus, let the ship's wake be let by a compass in the poop, and the opposite rumb is the true course made good by the ship; then the difference between this and the course given by the compass in the battacle, is the lee-way required. If the ship be within sight of land; then the lee-way may be exactly found by observing a point on the land which continues to bear the same way, and the distance between the point of the compass it lies upon and the point the ship capes at will be the lee-way. Thus suppose a ship at *C*, is lying up *NWb*, towards *A*; but instead of keeping that course, she is carried on the *NNE* line *CB*, and consequently the point *B* continues to bear the same way from the ship: Here it is evident that the angle *ACB*, or the distance between the *NbW* line that the ship capes at, and the *NNE* line that the ship really sails upon, will be the lee-way.

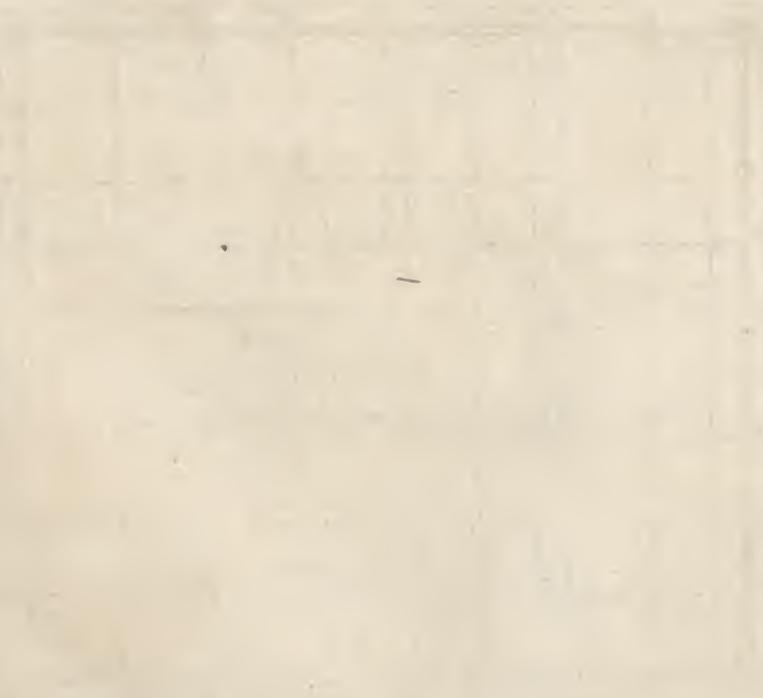
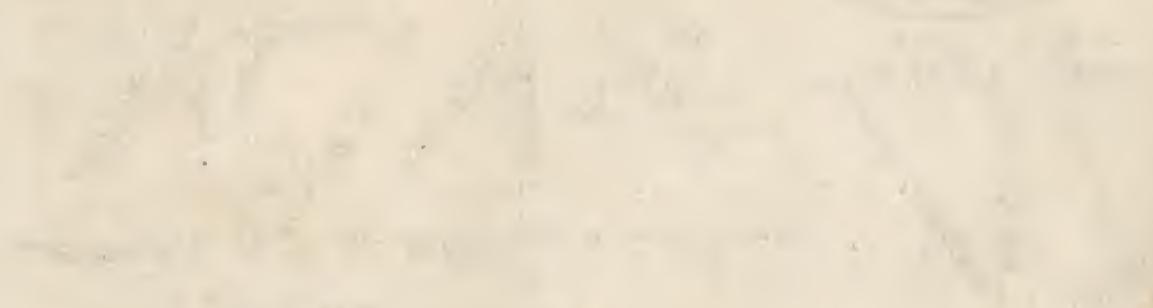
4. Having the course steered, and the lee-way, given; we may from thence find the true course by the following method, *viz.* Let your face be turned directly to the windward; and if the ship have her larboard tacks on board, count the lee way from the course steered towards the right hand; but if the starboard tacks be on board, then count it from the course steered towards the left hand. Thus, suppose the wind at north, and the ship lies up within 6 points of the wind, with her larboard tacks on board, making one point lee-way; here it is plain, that the course steered is *ENE*, and the true course *EbN*; also suppose the wind is at *NNW*, and the ship lies up within  $6\frac{1}{2}$  points of the wind with her starboard tack on board, making  $1\frac{1}{2}$  point lee way; it is evident that the true course, in this case, is *WSW*.

5. We have shewed, in the last section, how to find the variation of the compass; and from what has been said there, we have this general rule for finding the ship's true course, having the course steered and the variation given, *viz.* Let your face be turned towards the point of the compass upon which the ship is steered; and if the variation be easterly, count the quantity of it from the course steered towards the right hand; but if westerly, towards the left hand; and the course thus found is the true course steered. Thus, suppose the course steered is *NbE*, and the variation one point easterly; then the true course steered will be *NNE*: Also suppose the course steered is *NEbE*, and the variation one point westerly; then in this case, the true course will be *NE*; and so of others.

Hence, by knowing the lee-way variation, and course steered, we may from thence find the ship's true course; but if there be a current under foot, then that must be tried, and proper allowances made for it, as has been shown in the section concerning *Currents*, from thence to find the true course.

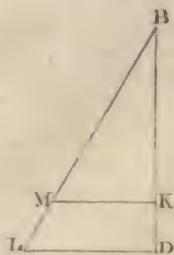
6. After making all the proper allowances for finding the ship's true course, and making as just an estimate of the distance as we can; yet by reason of the many accidents that attend a ship in a day's running, such as different rates of sailing between the times of heaving the log,

the

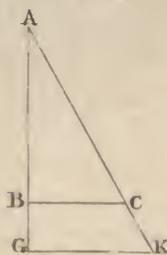




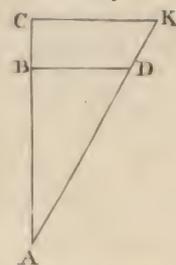
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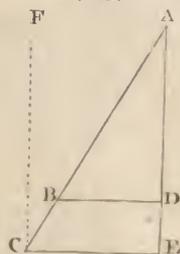
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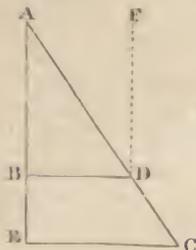
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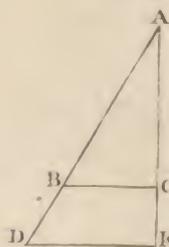
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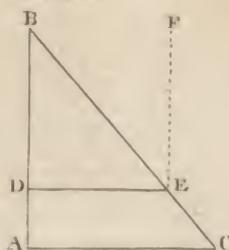
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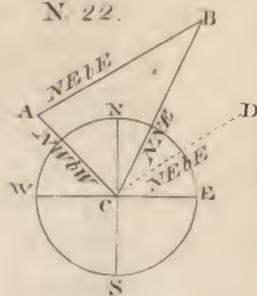
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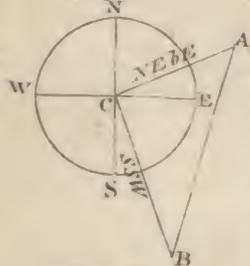
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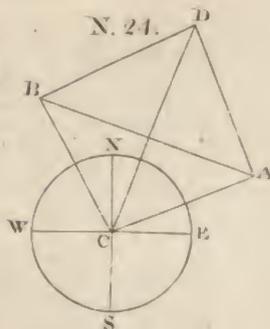
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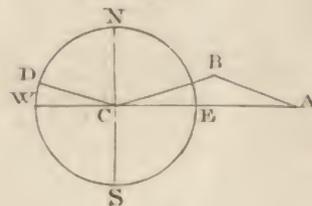
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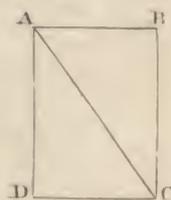
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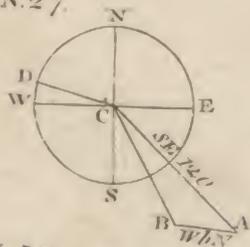
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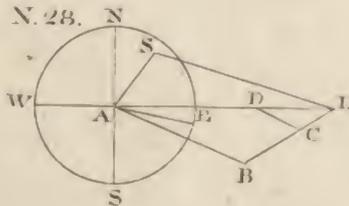
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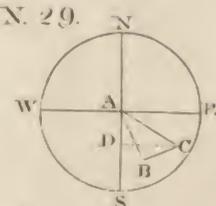
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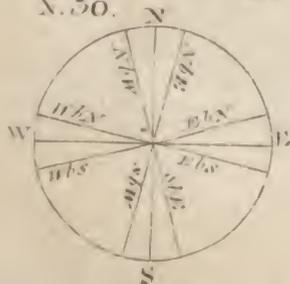
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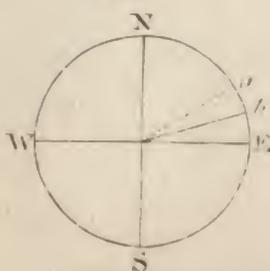
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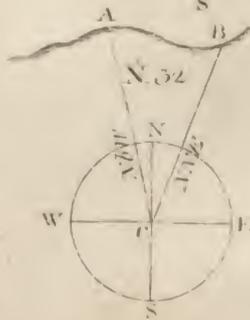
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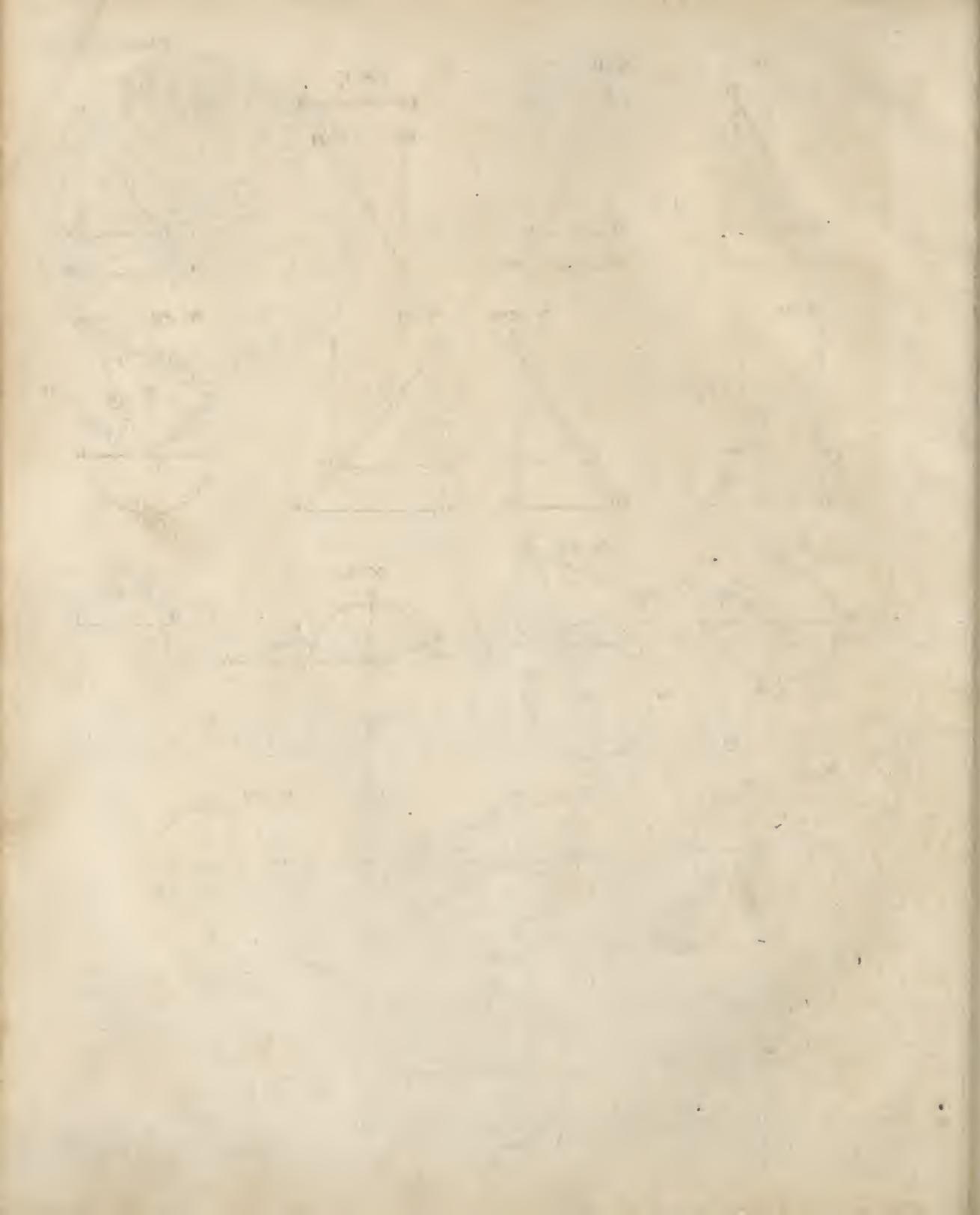


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N. 33.





the want of due care at the helm by not keeping her steady, but suffering her to yaw and fall off; sudden storms, when no account can be kept, &c.; the latitude by account frequently differs from the latitude by observation; and when that happens, it is evident there must be some error in the reckoning; to discover which, and where it lies, and also how to correct the reckoning, you may observe the following rules.

1st, If the ship sail near the meridian, or within 2 or 2½ points thereof; then if the latitude by account disagrees with the latitude by observation, it is most likely that the error lies in the distance run; for it is plain that in this case it will require a very sensible error in the course to make any considerable error in the difference of latitude, which cannot well happen if due care be taken at the helm, and proper allowances be made for the lee-way, variation, and currents. Consequently if the course be pretty near the truth, and the error in the distance run regularly through the whole, we may, from the latitude obtained by observation, correct the distance and departure by account, by the following analogies, viz.

As the difference of latitude by account is to the true difference of latitude, so is the departure by account to the true departure, and so is the direct distance by account to the true direct distance.

The reason of this is plain: for let AB (No. 33.) denote the meridian of the ship at A, and suppose the ship sails upon the rhomb AE near the meridian, till by account she is found in C, and consequently her difference of latitude by account is AB; but by observation she is found in the parallel ED, and so her true difference of latitude is AD, her true distance AE, and her true departure DE; then since the triangles ABC ADE are similar, it will be AB : AD :: BC : DE, and AB : AD :: AC : AE.

EXAMPLE. Suppose a ship from the latitude of 45° 20' north, after having sailed upon several courses near the meridian for 24 hours, her difference of latitude is computed to be upon the whole 95 miles southerly, and her departure 34 miles easterly; but by observation she is found to be in the latitude of 43° 10' north, and consequently her true difference of latitude is 130 miles southerly; then for the true departure, it will be, As the difference of latitude by account 95 is to the true difference of latitude 130, so is the departure by account 34 to the true departure 46.52, and so is the distance by account 100.9 to the true distance 138.

2dly, If the courses are for the most part near the parallel of east and west, and the direct course be within 5½ or 6 points of the meridian; then if the latitude by account differs from the observed latitude, it is most probable that the error lies in the course, or distance, or perhaps both; for in this case it is evident, the departure by account will be very nearly true; and thence by the help of this, and the true difference of latitude, may the true course and direct distance be readily found by *Case 4. of Plain Sailing.*

EXAMPLE. Suppose a ship from the latitude of 43° 50' north, after having sailed upon several courses near the parallel of east and west, for the space of 24 hours, is found by dead reckoning to be in the latitude of 42° 45' north, and to have made 160 miles of westing; but by a good observation the ship is found to be in the latitude of 42° 35' north: Required the true course, and direct distance sailed.

With the true difference of latitude 75 miles, and departure 160 miles, we shall find (by *Case 4. of Plain Sailing*) the true course to be S 64° 53' W, and the direct distance 176.7 miles.

3dly, If the courses are for the most part near the middle of the quadrant, and the direct course within 2 and 6 points of the meridian; then the error may be either in the course, or in the distance, or in both, which will cause an error both in the difference of latitude and departure; to correct which, having found the true difference of latitude by observation, with this, and the direct distance by dead reckoning, find a new departure (by *Case 3. of Plain Sailing*;) then half the sum of this departure, and that by dead reckoning, will be nearly equal to the true departure; and consequently with this, and the true difference of latitude, we may (by *Case 4. of Plain Sailing*) find the true course and distance.

EXAMPLE. Suppose a ship from the latitude of 44° 38' north, sails between south and east upon several courses, near the middle of the quadrant, for the space of 24 hours, and is then found by dead reckoning to be in the latitude of 42° 15' north, and to have made of easting 136 miles; but by observation she is found to be in the latitude of 42° 04' north: Required her true course and distance.

With the true distance of latitude 154 miles, and the direct distance by dead reckoning 197.4, you will find (by *Case 3. of Plain Sailing*) the new departure to be 123.4, and half the sum of this and the departure by dead reckoning will be 123.7 the true departure; then with this, and the true difference of latitude, you will find (by *Case 4. of Plain Sailing*) the true course to be S 39° 00' E, and the direct distance 198.2 miles.

7. In keeping a ship's reckoning at sea, the common method is to take from the log-board the several courses and distances stemmed by the ship last 24 hours, and to transfer these together with the most remarkable occurrences into the log-book, into which also are inserted the courses corrected, and the difference of latitude and difference of longitude made good upon each; then the whole day's work being finished in the log-book, if the latitude by account agree with the latitude by observation, the ship's place will be truly determined; if not, then the reckoning must be corrected according to the preceding rules, and placed in the journal.

The form of the Log-book and Journal, together with an example of 2 days work, you have here subjoined.

Note, To express the days of the week, they commonly use the characters by which the sun and planets are expressed, viz. ☉ denotes Sunday, ☾ Monday, ♀ Tuesday, ♃ Wednesday, ♃ Thursday, ♀ Friday, and ♄ denotes Saturday.

The FORM of the

## L O G - B O O K,

With the Manner of working Days Works at SEA.

H.	K.	$\frac{1}{2}$ K.	Courses.	Winds.	Observations and Accidents. Day of—
1					Fair weather, at four this afternoon
2				North	I took my departure from the Lizard, in the latitude of $5^{\circ} 00'$
3					north, it bearing NNE, distance five leagues.
4					
5	7		SW b S	N b E	
6	7				
7	7	I			
8	7	I			
9	6				
10	6				
11	6		SSW	E b S	The gale increasing and being under all our sails.
12	6	I			
1	6	I			After three this morning, frequent showers with thick weather till near noon.
2	6	I	SW b W	NNE	
3	6	I			
4	7				
5	7	I			
6	8				
7	8				
8	8		SW	ENE	The variation I reckon to be one point westerly.
9	8	I			
10	9				
11	8	I	SW $\frac{1}{2}$ W	N E b E	
12	8				

Courses Correct	Dist.	Diff. Lat.		Diff. long.	
		N	S	E	W
SSW	50		46.2		29.4
S b W	19		18.6		5.5
SW	49		29.7		45.5
SW b S	24.5		20.2		20.0
SW $\frac{1}{2}$ S	25.5		19.5		24.6
			144.2		125.0

Hence the ship, by account, has come to the latitude of  $47^{\circ} 46'$  north, and has differed her longitude  $2^{\circ} 5'$  westerly; so this day I have made my way good S  $31^{\circ}$   $31'$  W, distance 157.4 miles.

At noon the Lizard bore from me N  $31^{\circ}$   $31'$  E, distance 157.4 miles; and having observed the latitude, I found it agreed with the latitude by account.

The Log Book.			
H.	K.	Course.	Winds. Observations and Accidents. ♂— Day of—
1	2	SSW W	This 24 hours,
2	1	I	Handed the main frong gale of wind
2	1	I	and fore courses, and variable.
4	1	I	lee-way 6 points
5	1	I	
6	1		
7	1		
8	1	I	The wind increa-
9	1	I	sing, we tried a
10	1	I	hull, lee-way 7
11	1	I	points. The variation I
12	1	I	judge to be 1
			point west.
1	2	SW $\delta$ W NW $\delta$ W	
2	1	I	Set main-fail, lee-
3	1	I	way 4 $\frac{1}{2}$ points.
4	1		
5	1		
6	1	I	
7	1		
8	4	S $\delta$ E SW $\delta$ W	
9	4	I	Set fore-fail, lee-
10	4	I	way 3 points.
11	5		Lat. by observa-
12	4	I	tion, 47° 06' N.

The Log-Book.				
Course Correct.	Dist.	Diffr. Lat.		Diffr. Long.
		N	S	E W
S E $\delta$ E	32.5		17.8	37.7
E S E	6		2.3	10.6
S $\frac{1}{2}$ E	9		8.9	1.3
			29.0	49.6

Hence the ship, by account, has come to the latitude of 47° 17' north, and has differed her longitude 49' easterly; consequently she has got 1° 16' to the westward of the Lizard, and has made her way good the last 24 hours 849° 08' E, distance 44.3 miles.

At noon the Lizard bore from me north 17° 7' east, distance 170.6 miles.

This day I had an observation, and found the latitude by account to disagree with the latitude by observation by 11 minutes, I being so much further to the southward than by dead reckoning, which by the third of the preceding rules I correct as in the Journal.

A JOURNAL from the Lizard towards Jamaica in the ship Neptune, J. M. commander.

Week Days	Months Years	Month Days	Winds	Direct Course	Diffr. Miles	Latitude Correct	Whole Diff. Long. made	Bearing and Diffr. from the Lizard	Remarkable Observations and Accidents.
D			N $\delta$ E E $\delta$ S N N E E N E N E $\delta$ E	S 31, 31 W	157.4	47°, 46'	2°, 5' W	At noon the Lizard bore N. 31° 31' E. Diffr. 157.4 miles.	Fair weather at four P. M. I took my departure from the Lizard, it bearing NNE distance 5 leagues.
♂			West N W $\delta$ W S W $\delta$ W	S 34, 01 E	48.2	47°, 06'	1°, 35' W	At noon the Lizard bore S. 17° 55' W. Diffr. 183 miles.	Strong gales of wind and variable.

NAUMACHIA, in antiquity, a show or spectacle among the ancient Romans, representing a sea-fight.

NAUMBURG, a city of Germany, the capital of the county of Sax Naumburg, in Upper Saxony, situated in E. long. 12°, N. lat. 51° 15'.

NAUSEA, in medicine, a reaching, or propensity and endeavour to vomit, arising from a loathing of food, excited by some viscid humour that irritates the stomach.

NAUTICAL PLANISPHERE, a description of the terrestrial globe upon a plane for the use of mariners, more usually called chart.

NAUTILUS, in zoology, a genus belonging to the order of vermes testacea. The shell consists of one spiral valve, divided into several apartments by partitions. There are 17 species, principally distinguished by peculiarities in their shells.

NAVY, the fleet or shipping of a prince or state.

The management of the British navy-royal, under the lord high admiral of Great Britain, is entrusted to principal officers and commissioners of the navy, who hold their places by patent. The principal officers of the navy are four, *viz.* the treasurer, whose business it is to receive money out of the exchequer, and to pay all the charges of the navy, by warrant from the principal officers: comptroller, who attends and controls all payment of wages, is to know the rates of stores, to examine and audit all accounts, &c.: surveyor, who is to know the states of all stores, and see wants supplied; to estimate repairs, charge boatswains, &c. with what stores they receive, and at the end of each voyage to state and audit accounts: clerk of the acts, whose business it is to record all orders, contracts, bills, warrants, &c.

The commissioners of the navy are five: the first executes that part of the comptroller's duty which relates to the controlling the victuallers accounts; the second, another part of the said comptroller's duty, relating to the account of the store-keepers of the yard; the third has the direction of the navy at the port of Portsmouth; the fourth has the same at Chatham; and the fifth, at Plymouth.

There are also other commissioners at large, the number more or less according to the exigencies of public affairs; and since the increase of the royal navy, these have several clerks under them, with salaries allowed by the king.

The victualling of the royal navy hath formerly been undertaken by contract; but is now managed by commissioners, who hold their office on Tower-hill, London.

The navy-office is where the whole business concerning the navy is managed by the principal officers and commissioners.

The royal navy of Great Britain is now in a very flourishing state; having been diligently kept up in late reigns, as the natural strength of the kingdom. When it is complete, it is divided into three squadrons, distinguished by the different colours of the flags carried by the respective admirals belonging to the same.

NAXIA, or ΝΙΞΙΑ, one of the islands of the Archipelago,

about an hundred miles in circumference, situated in E. long. 26°, and N. lat. 36° 30'.

NAZARENES, in church history, a name originally given to all Christians in general, on account that Jesus Christ was of the city of Nazareth; but afterwards restrained to a sect of heretics, whose religion consisted of a strange jumble of Judaism and Christianity, observing at the same time the Mosaic law and the several rites of the Christian religion.

NAZARITES, among the Jews, persons who either of themselves, or by their parents, were dedicated to the observation of nazariteship. They were of two sorts: namely, such as were bound to this observance for only a short time, as a week or month; or those who were bound to it all their lives. All that we find peculiar in the latter's way of life, is, that they were to abstain from wine and all intoxicating liquors, and never to shave or cut off the hairs of their heads. The first sort of Nazarites were moreover to avoid all defilement; and if they chanced to contract any pollution before the term was expired, they were obliged to begin afresh. Women as well as men might bind themselves to this vow.

NEALED, among seamen, is used when the sounding is deep water close to the shore; as also when the shore is sandy, clayey, oozy, or foul and rocky ground.

NEAPED. When a ship wants water so that she cannot get out of the harbour, off the ground, or out of the dock, the seamen say she is neaped, or be-neaped.

NEATH, a town of Glamorganshire, in south Wales, situated on the river Neath, near the Bristol channel, twenty-eight miles north west of Landaff.

NEBULY, or NEBULEE, in heraldry, is when a coat is charged with several little figures, in form of words, running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved, as represented in Plate CXXXIV. fig. 3.

NECESSARY, in a philosophical sense, that which cannot but be, or cannot be otherwise.

NECESSITY, whatever is done by a necessary cause, or a power that is irresistible, in which sense it stands opposed to freedom. See METAPHYSICS.

NECK, in anatomy, is that slender part situated between the head and trunk of the body. - See ANATOMY.

NECKAR, a river of Germany, which rises in the south part of the circle of Swabia, and falls into the Rhine at Manheim.

NECROMANCY, a species of divination, performed by raising the dead, and extorting answers from them. See DIVINATION.

NECTAR, among ancient poets, the drink of the fabulous deities of the heathens, in contradistinction from their solid food, which was called ambrosia.

NECTARINE. See PERSICA.

NECTARIUM, among botanists. See BOTANY, p. 637.

NECYDALIS, in zoology, a genus of insects belonging to the order of coleoptera. The feelers are setaceous; the elytra are shorter and narrower than the wings; and the

the tail is simple. There are eleven species, chiefly distinguished by the size and figure of the clytra.

**NEEDHAM**, a market-town of Suffolk, situated on the river Orwel, eight miles north-west of Ipswich.

**NEEDLE**, a very common little instrument or utensil, made of steel, pointed at one end, and pierced at the other, used in sewing embroidery, tapestry, &c.

Needles make a very considerable article in commerce, though there is scarce any commodity cheaper, the consumption of them being almost incredible. The sizes are from n<sup>o</sup> 1. the largest, to n<sup>o</sup> 25 the smallest. In the manufacture of needles, German and Hungarian steel are of most repute.

In the making of them, the first thing is to pass the steel through a coal fire, and under a hammer, to bring it out of its square figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing iron, and returned into the fire, and drawn through a second hole of the iron, smaller than the first, and thus successively from hole to hole, till it has acquired the degree of fineness required for that species of needles, observing every time it is to be drawn, that it be greased over with lard, to render it more manageable. The steel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. These pieces are flatted at one end on the anvil, in order to form the head and eye; they are then put into the fire, to soften them farther; and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well tempered steel, and laid on a leaden block to bring out, with another puncheon, the little piece of steel remaining in the eye. The corners are then filed off the square of the heads, and a little cavity filed on each side of the flat of the head; this done, the point is formed with a file; and the whole filed over; they are then laid to heat red hot on a long flat narrow iron, crooked at one end, in a charcoal fire, and when taken out thence are thrown into a basin of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them soft; the medium is learned by experience. When they are thus hardened, they are laid in an iron shovel on a fire more or less brisk in proportion to the thickness of the needles; taking care to move them from time to time. This serves to temper them, and take off their brittleness; great care here too must be taken of the degree of heat. They are then straightened one after another with the hammer, the coldness of the water used in hardening them having twisted the greatest part of them.

The next process is the polishing them. To do this, they take twelve or fifteen thousand needles, and range them in little heaps against each other on a piece of new buckram sprinkled with emery-dust. The needles thus disposed, emery dust is thrown over them, which is again sprinkled with oil of olives; at last the whole is made up into a roll, well bound at both ends. This roll is then laid on a polishing table, and over it a thick plank loaden with stones, which two men work backwards and forwards a day and a half or two days, successively, by which means the roll thus continually agitated by the weight and motion of the plank

over it, the needles withinside being rubbed against each other with oil and emery are insensibly polished. After polishing, they are taken out, and the filth washed off them with hot water and soap: they are then wiped in hot bran, a little moistened, placed with the needles in a round box, suspended in the air by a cord, which is kept stirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden vessels, to have the good separated from those whose points or eyes have been broke either in polishing or wiping; the points are then all turned the same way, and smoothed with an emery-stone turned with a wheel. This operation finishes them, and there remains nothing but to make them into packets of two hundred and fifty each.

**Magnetical NEEDLE**, in navigation, a needle touched with a loadstone, and sustained on a pivot or centre; on which playing at liberty, it directs itself to certain points in or under the horizon. See NAVIGATION.

**NEEDLE FISH**. See SYNGNATHUS.

**NEEDLES**, twocapes, or head-lands, at the west end of the isle of Wight, which is very difficult to pass on account of the sands and rocks.

**NEFASTI DIES**, in Roman antiquity, an appellation given to such days wherein it was not allowed to administer justice, usually marked in the calendar by N. or N. P. *i. e.* nefastus prima, when only nefastus for the first part of it.

**NEGAPATAN**, a port-town of the hither India, situated on the coast of Coromandel: E. long. 79°, N. lat. 11° 15'.

**NEGATION**, in logic, an act of the mind affirming one thing to be different from another; as, that the soul is not matter.

**NEGATIVE**, in general, something that implies a negation: thus we say, negative quantities, negative signs, negative powers, &c. See METAPHYSICS and LOGIC.

**NEGOMBO**, a port-town on the west coast of the isle of Ceylon, in the Indian ocean, subject to the Dutch: E. long. 78°, N. lat. 7° 25'.

**NEGRAIS**, a port-town of Pegu, in the further India, situated on the west side of the bay of Bengal: E. lon. 92° 30', N. lat. 17°.

**NEGRIL POINT**, the most westerly promontory of the island of Jamaica.

**NEGROES**, properly the inhabitants of Nigritia in Africa, also called blacks and moors; but this name is now given to all the blacks.

The origin of the negroes, and the cause of this remarkable difference from the rest of the human species, has much perplexed the naturalists. Mr. Boyle has observed, that it cannot be produced by the heat of the climate: for though the heat of the sun may darken the colour of the skin, yet experience does not shew that it is sufficient to produce a new blackness, like that of the negroes.

In Africa itself, many nations of Æthiopia are not black, nor were there any blacks originally in the West Indies. In many parts of Asia, under the same parallel with the African region, inhabited by blacks,

the people are but tawny. He adds, that there are negroes in Africa, beyond the southern tropic; and that a river sometimes parts nations, one of which is black and the other only tawny. Dr Barriere alledges that the gail of negroes is black, and being mixed with their blood is deposited between their skin and scarf-skin. However, Dr Mitchel of Virginia, in the philosophical transactions, n<sup>o</sup> 476, has endeavoured by many learned arguments to prove, that the influence of the sun in hot countries, and the manner of life of their inhabitants, are the remote causes of the colour of negroes, indians, &c. and indeed it would be a strong confirmation of his doctrine, if we would see any people, originally white, become black and woolly by transplantation, or *vice versa*.

Negroes are brought from Guinea, and other coasts of Africa, and sent into the colonies in America, to cultivate tobacco, sugar, indigo, &c. and in Mexico and Peru, to dig in the mines; and this commerce, which is scarce defensible on the foot either of religion or humanity, is now carried on by all the nations that have settlements in the West Indies. Those negroes make the best slaves who are brought from Angola, Senegal, Cape Verd, the river Gambia, the kingdoms of Joloffes, Daniel, Galland, &c.

There are various ways of procuring them: some, to avoid famine, sell themselves, their wives and children, to their princes, or other great men; others are made prisoners of war; and great numbers are seized in excursions made for that very purpose by the petty princes upon one another's territories, in which it is usual to sweep away all without distinction of age or sex.

**NEGROES-ISLAND**, one of the Philippine islands, in the Indian ocean, subject to Spain; so called, because most of the inhabitants are blacks: E. lon. 120°, N. lat. 10°.

**NEGROLAND**, or **NIGRITIA**, a country of Africa, which lies between 18° west and 15° east longitude, and between 10° and 20° of north latitude, the great river Niger running through it. It is bounded by Zaara, or the desert, on the north, by unknown countries on the east, by Guinea on the south, and by the Atlantic ocean on the west.

**NEGROPONT**, or **ΕΓΡΙΠΟΣ**, the capital of the island of Negropont, anciently called Euboea, situated in the Archipelago, on the west side of the island; where the strait is so narrow, that it is joined to the continent by a bridge: E. lon. 24° 30', N. lat. 38° 30'.

**NEHEMIAH**, a canonical book of the Old Testament so called from the name of its author. Nehemiah was born in Babylon, during the captivity, and succeeded Ezra in the government of Judah and Jerusalem. He was a Jew, and was promoted to the office of cup-bearer to Artaxerxes Longimanus king of Persia; when the opportunities he had of being daily in the king's presence, together with the favour of Esther the queen, procured him the favour of being authorized to repair and fortify the city of Jerusalem, in the same manner as it was before its destruction by the Babylonians. On his going to Jerusalem, he fi-

nished the rebuilding of the walls in fifty-two days, and dedicated the gates of the city with great solemnity. He then reformed some abuses which had crept in among his countrymen, particularly the extortion of the usurers, by which the poor were so oppressed as to be forced to sell their lands and children for support: after which he returned to Persia, and came back again with a new commission, by virtue of which he regulated every thing relating both to the state and religion of the Jews. The history of these transactions is the subject of this book.

**NELLENBURG**, a city of Swabia, in Germany, capital of a county of the same name, situated fifteen miles north of Constance.

**NEMÆA**, a town in the Morea, thirty miles south of Corinth, where the ancient Nemæan games were celebrated.

**NEMÆAN GAMES**, were so called from Nemæa, a village between the cities of Cleonæ and Philus, where they were celebrated every third year. The exercises were chariot races, and all the parts of the pentathlon. These games were instituted in memory of Opheltes, or Archemorus, the son of Euphetes and Creusa, and nursed by Hypsipyle; who leaving him in a meadow, while she went to shew the besiegers of Thebes a fountain, at her return found him dead, and a serpent twined about his neck; whence the fountain, before called Laniæ, was named Archemorus; and the captains, to comfort Hypsipyle, instituted these games. Others ascribe their institution to Hercules, after his victory over the Nemæan lion.

**NEMOURS**, a city in the isle of France, forty-two miles south of Paris: E. long 2° 45', N. lat. 48° 17'.

**NEOMENIA**, or **ΝΟΥΜΕΝΙΑ**, a festival of the ancient Greeks, at the beginning of every lunar month, which was, as the name imports, observed upon the day of the new moon, in honour of all the gods, but especially Apollo, who was called Neomenios; because the sun is the fountain of light, and whatever distinction of times and seasons may be taken from other planets, yet they are all owing to him as the original of those borrowed rays by which they shine.

**NEOPHYTES**, *new plants*, a name given by the ancient Christians to those heathens who had newly embraced the faith; such persons being considered as regenerated, or born anew by baptism. The term neophytes has been also used for new priests, or those just admitted into orders, and sometimes for the novices in monasteries. It is still applied to the converts made by the missionaries among the infidels.

**NEOTTIA**, in botany. See **OPHYRS**.

**NEPA**, in zoology, a genus of insects belonging to the order of hemiptera. The rostrum is inflected; the antennæ are shorter than the thorax; and the hind-feet are hairy, and fitted for swimming. There are seven species.

**NEPENTHES**, in botany, a plant of the gynandria tetrandria class. The calix consists of four segments; it has no corolla; and the capsule has four cells. There is but one species, a native of Ceylon.

**NEPER'S RODS**, or **BONES**, an instrument invented by



Fig. 1. NEPERS RODS

N.1.

1	1	2	3	4	5	6	7	8	9	0
2	2	4	6	8	10	12	14	16	18	0
3	3	6	9	12	15	18	21	24	27	0
4	4	8	12	16	20	24	28	32	36	0
5	5	10	15	20	25	30	35	40	45	0
6	6	12	18	24	30	36	42	48	54	0
7	7	14	21	28	35	42	49	56	63	0
8	8	16	24	32	40	48	56	64	72	0
9	9	18	27	36	45	54	63	72	81	0

N.2.

1	4	7	6	8
2	8	14	12	16
3	12	21	18	24
4	16	28	24	32
5	20	35	30	40
6	24	42	36	48
7	28	49	42	56
8	32	56	48	64
9	36	63	54	72

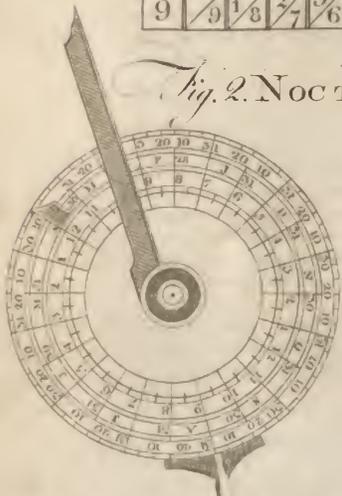
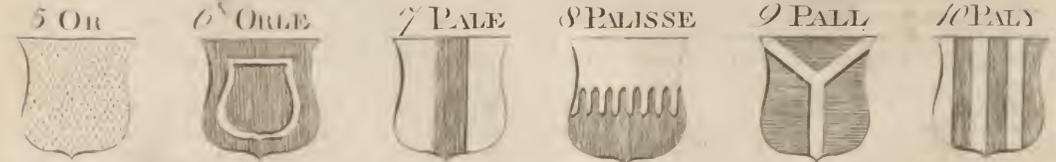
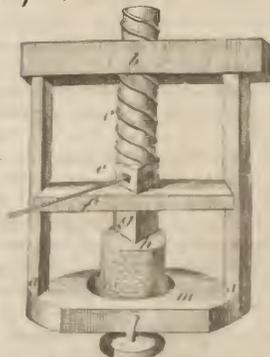


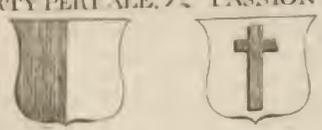
Fig. 3. NEBULY



Fig. 4. OLIVE PRESS



11 PARTY PERPALE. 12 PASSION CROSS



13 PATEL. 14 PATRIARCHAL CROSS



Fig. 15. PERAMBULATOR



16. PILE



by J. Neper, baron of Merchiston, in Scotland, whereby the multiplication and division of large numbers are much facilitated.

*As to the construction of NEPER'S RODS:* suppose the common table of multiplication to be made upon a plate of metal, ivory, or paste-board, and then conceive the several columns (standing downwards from the digits on the head) to be cut asunder; and these are what we call Neper's rods for multiplication. But then there must be a good number of each; for as many rods as any figure is in the multiplicand, so many rods of that species (*i. e.* with that figure on the top of it) must we have; though six rods of each species will be sufficient for any example in common affairs: there must also be as many rods of 0's.

But before we explain the way of using these rods, there is another thing to be known, *viz.* that the figures on every rod are written in an order different from that in the table. Thus, the little square space or division in which the several products of every column are written, is divided into two parts by a line across from the upper angle on the right to the lower on the left; and if the product is a digit, it is set in the lower division; if it has two places, the first is set in the lower, and the second in the upper division; but the spaces on the top are not divided; also there is a rod of digits, not divided, which is called the index rod, and of this we need but one single rod. See the figure of all the different rods, and the index, separate from one another, in Plate CXXXIV. fig. 1.

*Multiplication by NEPER'S RODS.* First lay down the index rod; then on the right of it set a rod whose top is the figure in the highest place of the multiplicand; next to this again, set the rod whose top is the next figure of the multiplicand; and so on in order, to the first figure. Then is your multiplicand tabulated for all the nine digits; for in the same line of squares standing against every figure of the index rod, you have the product of that figure, and therefore you have no more to do but to transfer the products and sum them. But in taking out these products from the rods, the order in which the figures stand obliges you to a very easy and small addition; thus, begin to take out the figure in the lower part, or unit's place, of the square of the first rod on the right; add the figure in the upper part of this rod to that in the lower part of the next, and so on, which may be done as fast as you can look on them. To make this practice as clear as possible, take the following example.

Example: To multiply 4768 by 185. Having set the rods together for the number 4768 (*ibid* n<sup>o</sup> 2.) against 5 in the index, I find this number, by adding according to the rule, - - - - - 23840  
Against 8, this number - - - - - 38144  
Against 3, this number - - - - - 14304

Total product 1835680

To make the use of the rods yet more regular and easy, they are kept in a flat square box, whose breadth is that of ten rods, and the length that of one rod, as thick as to hold six (or as many as you please) the

capacity of the box being divided into ten cells for the different species of rods. When the rods are put up in the box (each species in its own cell distinguished by the first figure of the rod set before it on the face of the box near the top) as much of every rod stands without the box as shews the first figure of that rod; also upon one of the flat sides without and near the edge, upon the left hand, the index rod is fixed; and along the foot there is a small ledge, so that the rods when applied are laid upon this side, and supported by the ledge, which makes the practice very easy; but in case the multiplicand should have more than nine places, that upper face of the box may be made broader. Some make the rods with four different faces, and figures on each for different purposes.

*Division by NEPER'S RODS.* First tabulate your divisor; then you have it multiplied by all the digits, out of which you may chuse such convenient divisors as will be next less to the figures in the dividend, and write the index answering in the quotient, and so continually till the work is done. Thus 2179788, divided by 6123, gives in the quotient 356.

Having tabulated the divisor 6123, you see that 6123 cannot be had in 2179; therefore take five places, and on the rods find a number that is equal or next less to 21797, which is 18369; that is, 3 times the divisor; wherefore set 3 in the quotient, and subtract 18369 from the figures above, and there will remain 3428; to which add 8, the next figure of the dividend, and seek again on the rods for it, or the next less, which you will find to be five times; therefore set 5 in the quotient, and subtract 30615 from 34288, and there will remain 3673; to which add 8, the last figure in the dividend, and finding it to be just 6 times the divisor, set six in the quotient.

6123)2179788(356  
18369

34288  
30615  
-----  
36738  
36738  
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NEPETA, in botany, a genus of the didynamia gymnospermia class. The intermediate lacinium of the inferior lip is crenated; the margin of the faux is reflexed; and the stamina are near each other. There are 14 species, only one of which, *viz.* the cataria, nap, or cat-mint, is a native of Britain.

NEPHEW, a term relative to uncle and aunt, signifying a brother or sister's son; who, according to the civil law, is in the third degree of consanguinity; but according to the canon, in the second.

NEPHRITIC, something that relates to the kidneys.

NEPHRITIC WOOD, a wood of a very dense and compact texture, and of a fine grain, brought us from New Spain, in small blocks, in its natural state, and covered with its bark.

This wood is a very good diuretic, and is said to be

of great use with the Indians in all diseases of the kidneys and bladder, and in suppressions of urine, from whatever cause. It is also recommended in fevers and obstructions of the viscera. The way of taking it, among the Indians, is only an infusion in cold water.

**NEPHRITICS**, in pharmacy, medicines proper for diseases of the kidneys, especially the stone.

Such particularly are the roots of althæa, dog's grass, asparagus, sago, pellitory of the wall, mallows, pimpernel, red chick pease, peach kernels, turpentine, the nephritic stone, the nephritic wood, &c. and diuretics.

**NEPHRITIS**, in medicine, an inflammation of the kidneys. See **MEDICINE**.

**NEREIDS**, in the pagan theology, sea-nymphs, daughters of Nereus and Doris.

The nereids were esteemed very handsome, inasmuch that Cassiope, the wife of Cepheus king of Ethiopia, having triumphed over all the beauties of the æge, and daring to vie with the nereids, they were so enraged that they sent a prodigious sea-monster into the country; and to appease them, she was commanded by the oracle to expose her daughter Andromeda, bound to a rock, to be devoured by the monster.

In ancient monuments the nereids are represented riding upon sea-horses, sometimes with an entire human form, and at other times with the tail of a fish.

**NEREIS**, in zoology, a genus belonging to the order of vermes mollusca. The body is oblong, linear, and fitted for creeping; it is furnished with lateral pincilled tentacula. There are eleven species.

**NERICIA**, a province of Sweden, bounded by Westmania on the north, by Sunderland on the east, and by Gothland on the south and west.

**NERIUM**, in botany, a genus of the pentandria monogynia class. The seeds are furnished with plumes; and the tube of the corolla terminates in a lacerated corona. There are four species, none of them natives of Britain.

**NERVES**, in anatomy. See **ANATOMY**, p. 247.

**NEST**. See **NIDUS**.

**NESTORIANS**, a Christian sect, the followers of Nestorius, bishop and patriarch of Constantinople; who, about the year 529, taught that there were two persons in Jesus Christ, the divine and the human, which are united, not hypostatically or substantially, but in a mystical manner; whence he concluded, that Mary was the mother of Christ and not the mother of God. For this opinion, Nestorius was condemned and deposed by the council of Ephesus; and the decree of this council was confirmed by the emperor Theodosius, who banished the bishop to a monastery.

**NETHERLANDS**, anciently called Belgia, but since denominated Low-Countries or Netherlands from their low situation, are situated between 2° and 7° of east longitude, and between 50° and 53° 30' of north latitude; and are bounded by the German sea on the north, Germany on the east, by Lorrain and France on the south, and by another part of France and the British seas on the west; extending near three hundred

miles in length from north to south, and two hundred miles in breadth from east to west. They consist of seventeen provinces; ten of which are called the Austrian and French Netherlands, and the other seven the United Provinces.

**NETTINGS**, in a ship, a sort of grates made of small ropes seized together with rope-yarn or twine, and fixed on the quarters and in the tops; they are sometimes stretched upon the ledges from the waste trees to the roof trees, from the top of the forecastle to the poop; and sometimes are laid in the waste of a ship, to serve instead of gratings.

**NETTLE**, in botany. See **URTICA**.

**Dead NETTLE**. See **LAMIUM**.

**NETTLE-TREE**. See **CELTIS**.

**NETTUNO**, a port town of Italy, in the Campagna di Roma; situated on the Mediterranean, thirty miles south-east of Rome.

**NEVERS**, a city of France, capital of the Nivernois: E. long. 3° 15', N. lat. 46° 50'.

**NEUFCHÂTEL**, the capital of the counties of Neufchâtel and Vallengin, in Switzerland which together form one free and independent state, subject to the king of Prussia: E. long. 6° 35', N. lat. 47° 10'.

**NEUFCHÂTEL** is also a town of Normandy in France, twenty three miles north-east of Rouen.

**NEVIN**, or **NEWIN**, a market town of North-Wales eighteen miles south-west of Caernarvon.

**NEVIS**, one of the Caribbee-islands, divided from the east end of St. Christophers by a narrow channel.

**NEURADA**, in botany, a genus of the decandria decagynia class. The calix consists of five segments, and the corolla of five leaves; the capsule has ten cells, and ten sharp-pointed seeds. There is but one species, a native of Egypt.

**NEURITICS**, in pharmacy, medicines good in disorders of the nerves.

**NEUROGRAPHY**, signifies a description of the nerves. **NEUROPTERA**. See **NATURAL HISTORY**, p. 364, col. 1.

**NEUSTAT**, a city of Germany, thirty miles south of Vienna.

**NEUSTAT** is also a town of Lower Saxony, sixteen miles north-west of the city of Hanover.

**NEUTER**, or **NEUTER GENDER**, in grammar, one of the three genders of nouns, so called as being neither masculine nor feminine. See **GRAMMAR**.

**NEUTRAL SALTS**, among chemists, a sort of salts neither acid nor alkaline, but partaking of the nature of both. See **CHEMISTRY**.

**NEUTRALITY**, the state of a person or thing that is neuter, or that takes part with neither side.

**NEWARK**, a borough town of Nottinghamshire, fifteen miles north-east of Nottingham. It sends two members to parliament.

**NEWBOROUGH**, a market town of Anglesey, fifteen miles north-west of Beaumaris.

**NEUBURG**, a city of Bavaria, in Germany, twenty eight miles north-east of Augsburg.

**NEUBURG** is also the name of two other towns of Germany;

many; one in Swabia, twenty five miles west of Stuttgart; and the other likewise in Swabia, twelve miles north of Basil.

**NEWBURY**, a market town of Berkshire, fifteen miles west of Reading.

**NEWCASTLE**, the county-town of Northumberland, situated upon the river Tyne: W. long.  $1^{\circ} 10'$ , N. lat.  $55^{\circ}$ . It sends two members to parliament.

**NEWCASTLE**, a borough-town of Staffordshire, ten miles north of Stafford. It sends two members to parliament.

**NEWCASTLE**, a market town of Caermarthenshire, in South Wales, fifteen miles north of Caermarthen.

**NEWEL**, in architecture, is the upright post which a pair of winding stairs turn about; this is properly a cylinder of stone which bears on the ground, and is formed by the end of the steps of the winding stairs.

**NEWFIDDLERS SEA**, a lake thirty five miles long, on the north-west part of Upper Hungary.

**NEW FOREST**, a part of Hampshire, opposite to the Isle of Wight, appropriated by act of parliament for the growth of oaks to build the royal navy. See **FOREST**.

**NEWFOUNDLAND**, a triangular island, three hundred and fifty miles in length from north to south, and two hundred miles in breadth at the base from east to west; situated in North America, between  $55^{\circ}$  and  $61^{\circ}$  of west longitude, and between  $47^{\circ}$  and  $52^{\circ}$  of north latitude; bounded by the narrow straits of Bellisle on the north, by the Atlantic ocean on the east and south, and by the bay of St. Lawrence on the west. It is subject to England; but the fishing banks on this coast are frequented by most European nations.

**NEUHAUSEL**, a city of Upper Hungary, situated on the river Neytra: E. long.  $18^{\circ} 12'$ , N. lat.  $48^{\circ} 25'$ .

**NEUMARK**, a city of Transilvania, subject to the house of Austria: E. long.  $23^{\circ} 25'$ , N. lat.  $47^{\circ} 35'$ .

**NEUMARK** is also a town of Germany in the palatinate of Bavaria, thirty miles north-west of Ratibon.

**NEUMARKET**, a market town, situated both in Cambridgeshire and Suffolk, twelve miles east of Cambridge.

**NEUNHAM**, a market town, ten miles south-west of Gloucester.

**NEWPORT**, a port town of Flanders, nine miles south-west of Ostend.

**NEWPORT** is also a borough town of the Isle of Wight, which sends two members to parliament.

**NEWPORT** is also a borough of Cornwall, ten miles west of Launceston, which sends two members to parliament.

**NEWPORT** is also the name of several market towns; one fifteen miles east of Shrewsbury, another eighteen miles south-west of Monmouth, and a third sixteen miles north-east of St Davids.

**NEWPORT-PAGNEL**, a market-town, sixteen miles north of Aillsbury.

**NEWSTAT**, the name of several towns; one eight miles north of Landau; another fifteen miles south-west of Ratibon; a third in Silesia, fifteen miles south

of Breslaw; a fourth in Hungary, sixty-five miles east of Tockay; and a fifth in Moravia, ten miles north of Olmutz.

**NEWT**, or **EFF**, in zoology. See **LACERTA**.

**NEWTON**, a borough town, thirty five-miles south of Lancaster.

It sends two members to parliament.

**NEWTON** is also a borough town in the Isle of Wight, twelve miles south of Southampton: it sends two members to parliament.

**NEWTONIAN PHILOSOPHY**, the doctrine of the universe, and particularly of the heavenly bodies, their laws, affections, &c. as delivered by Sir Isaac Newton. See **ASTRONOMY**, **MECHANICS**, **OPTICS**, &c.

**NEYLAND**, a market-town of Suffolk, fourteen miles south-west of Ipswich.

**NIAGARA**, a prodigious cataract in Canada, in North America, between the lakes Erie and Ontario, where the water falls from high rocks 156 feet perpendicular. The mist which this fall occasions may be seen at fifteen miles distance rising as high as the clouds, and forming a beautiful rainbow.

**NIBANO**, a town of Italy, in the duchy of Parma, thirty five miles west of Parma.

**NICARAGUA**, a province of Mexico, bounded by the province of Honduras on the north, by the North-sea on the east; by the province of Costarica on the south-east, and by the South sea on the south-west; being 400 miles long, and 120 broad. Nicaragua lake runs through the middle of the province.

**NICARIA**, one of the islands of the Archipelago, in Asiatic Turkey: E. long.  $26^{\circ} 5'$ , N. lat.  $37^{\circ}$ .

**NICASTRO**, a town of Naples, in the territory of Calabria; E. long.  $16^{\circ} 40'$ , N. lat.  $39^{\circ} 15'$ .

**NICE**, the capital of the county of the same name, situated on the mediterranean, at the mouth of the river Var: E. long.  $7^{\circ} 15'$ , N. lat.  $43^{\circ} 40'$ .

**NICE** is also a town of Asiatic Turkey, fifty miles south-east of Constantinople.

**NICHE**, in architecture, a hollow sunk into a wall, for the commodious and agreeable placing a statue.

**NICOBAR ISLANDS**, a cluster of islands situated in the Indian ocean, at the entrance of the gulph of Bengal, between  $7^{\circ}$  and  $10^{\circ}$  N. lat.

**NICOLAITANS**, in church-history, Christian heretics who assumed this name from Nicolas of Antioch; who, being a Gentile by birth, first embraced Judaism, and then Christianity; when his zeal and devotion recommended him to the church of Jerusalem, by whom he was chosen one of the first deacons. Many of the primitive writers believe that Nicolas was rather the occasion than the author of the infamous practices of those who assumed his name, who were expressly condemned by the spirit of God himself, Rev. ii. 6. And indeed their opinions and actions were highly extravagant and criminal. They allowed a community of wives; made no difference between ordinary meats and those offered to idols. According to Eusebius, they subsisted but a short time; but Tertullian says, that they only changed their name, and that their heresies passed into the sect of the Cainians.

**St. NICOLAS**, a town of Lorraine, ten miles south-east of Nancy, at the mouth of the river Dvina.

**St. NICOLAS** is also a port-town of Russia situated on the White sea, six miles below Archangel.

**St. NICOLAS'S DAY**, a festival of the Romish church, observed on the 6th of December.

**NICOMEDIA**, a city of Asiatic Turkey, thirty miles south east of Constantinople.

**NICOPOLIS**, a city of European Turkey, situated on the Danube, 100 miles north west of Adrianople: E. long. 25°, N. lat. 43°.

**NICOPPING**, a city of Sweden, in the province of Sunderland, fifty miles south of Stockholm.

**NICOPPING** is also the capital of the island Hulfster, subject to Denmark, and forty-eight miles south-west of Copenhagen.

**NICOSIA**, the capital of the island of Cyprus: E. long. 35°, N. lat. 35°.

**NICOTERA**, a port town of the kingdom of Naples, thirty miles north east of Reggio.

**NICOTIANA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel shaped, with a plaited limb; and the stamina are inclined; and the capsule has two valves and two cells. There are 7 species, all natives of warm climates. The nicotiana tabacum, or tobacco, was first brought into Europe about the year 1560, from the island Tobago in America. It is cultivated in the following manner.

After sowing the tobacco seeds, the ground is watered every day, and in hot weather covered to prevent its being scorched by the sun; and when the plants are grown to a convenient pitch, they are transplanted into a soil well prepared for their reception: care is also taken to keep this ground clear of weeds, and to pull off the lowest leaves of the plant, that ten or fifteen of the finest leaves may have all the nourishment. When these leaves are ripe, which is known by their breaking when bent, the stalks are cut, and left to dry two or three hours in the sun; after which they are tied together two and two, and hung on ropes under a shade to be dried in the air. And when the leaves are sufficiently dried, they are pulled from off the stalks, and made up in little bundles; which being steeped in seawater, or, for want thereof, in common water, are twisted in manner of ropes, and the twils formed into rolls, by winding them with a kind of mill around a stick: in which condition it is imported into Europe, where it is cut by the tobaccoists for smoking, formed into snuff, and the like. See **SNUFF**.

Besides the tobacco of the West-Indies, there are considerable quantities cultivated in the Levant, the coasts of Greece and the Archipelago; the island of Malta and Italy.

The marks of good twist-tobacco, are a fine shining cut, an agreeable smell, and that it have been well kept. Tobacco is either taken by way of snuff, as a sternutatory; or as a masticatory, by chewing it in the mouth; or by smoking it in a pipe. It is sometimes also taken in little longish pellets put up the nose, where it is found to produce very good effects, to attract a deal of water or pituita, unload the head, resolve catarrhs, and make

a free respiration; for the subtil parts of the tobacco in inspiration, are carried into the trachea and lungs, where they loosen the peccant humours adhering thereto, and promote expectoration. Some have left this tobacco in their noses all night; but this is found to occasion vomiting the next morning. Another thing charged on this way of application, is, that it weakens the sight. When taken in great quantities in the way of snuff, it is found to prejudice the smelling, greatly diminishes the appetite, and in time gives rise to a phtisis. That taken in the way of smoke, dries and damages the brain. Borghi, in a letter to Bartholine, mentions a person who through excess of smoking had dried his brain to that degree, that after his death there was nothing found in his skull but a little black lump, consisting of mere membranes.

Some people use the infusion of tobacco as an emetic; but it is a very dangerous and unjustifiable practice, and often produces violent vomiting, sickness, and stupidity.

Bates and Fuller give some receipts, in which tobacco is an ingredient, with mighty encomiums in asthmatic cases. A strong decoction of tobacco, with proper carminatives and cathartics, given clyster-wise, sometimes proves of good effect in what is usually called the stone-cholic, and also in the iliac passion. A drop or two of the chymical oil of tobacco, being put on the tongue of a cat, produces violent convulsions, and death itself in the space of a minute; yet the same oil used in list, and applied to the teeth, has been of service in the tooth-ach: though it must be to those that have been used to the taking of tobacco; otherwise, great sickness, reachings, vomitings, &c. happen; and even in no case is the internal use of it warranted by ordinary practice.

A strong decoction of the stalks, with sharp-pointed dock and alum, is said to be of good service, used externally, in cutaneous distempers, especially the itch: some boil them for that purpose in urine. The same is said to be infallible in curing the mange in dogs.

Beat into a mash with vinegar, or brandy it has been found serviceable for removing hard tumours of the hypochondria

**NICOYA**, or **St. LUCAR**, a port-town of Mexico, situated on a bay of the South Sea, in 88° W. long. and 10° 15' N. lat.

**NICTITATING MEMBRANE**, a thin membrane, chiefly found in the bird and fish kind, which covers the eyes of these animals, sheltering them from the dust or too much light; yet is so thin and pellucid, that they can see pretty well through it.

**NIDUS**, among naturalists signifies a nest, or proper repository for the eggs of birds, insects, &c. wherein the young of these animals are hatched and nursed.

**NIECE**, a brother or sister's daughter, which in the civil law is reckoned the third degree of consanguinity.

**NIEMEN**, or **BEREZINA**, a river of Poland, which rises in Lithuania, and falls into a bay of the Baltic sea, near Memel.

**NIEPER**, or **BORISTHENES**, a river which rises in the middle of Russia; and running south through Poland, enters

enters the Russian Ukraïn, separates Little Tartary from Budziac Tartary, and falls into the Black Sea near Ozzakow.

**NIESTAT**, a town of Lower Saxony, in the duchy of Mecklenburg: E. long  $11^{\circ} 26'$ , N. lat.  $53^{\circ} 40'$ .

**NIESTAR** is also a town of Upper Saxony, in the marquisate of Brandenburg, 25 miles north-east of Berlin.

**NIESTER**, a river which rises in Poland, and running fourth east divides Podolia in Poland from Moldavia in Turkey; and afterwards, dividing Bessarabia from Budziac Tartary, falls into the Black Sea near Belgorod.

**NIGELLA**, in botany, a genus of the polyandria pentagynia class. The calix is wanting; the corolla consists of five petals; there are five trilocular nectaria within the corolla; and there are five connected capsules. The species are five, none of them natives of Britain.

**NIGER**, a great river of Africa, which runs from east to west through the middle of Negroland, and discharges itself into the Atlantic ocean by three channels, called Rio Grande, Gambia, and the river Senega. It is 300 miles between the northern and southern channels; and all the country between them is annually overflowed, as Egypt is by the Nile.

**NIGHT**, that part of the natural day during which the sun is underneath the horizon; or that space wherein it is dusky.

Night was originally divided by the Hebrews, and other eastern nations, into three parts; or watchings. The Romans, and afterwards the Jews from them, divide the night into four parts, or watches, the first of which began at sunset and lasted till nine at night, according to our way of reckoning; the second lasted till midnight; the third till three in the morning; and the fourth ended at sunrise. The ancient Gauls and Germans divided their time, not by days, but by nights; and the people of Iceland, and the Arabs, do the same at this day. The like is also observed of our Saxon ancestors.

**NIGHT-MARE**, in medicine. See **MEDICINE**, p. 157.

**NIGHT-WALKERS**. See **NOCTAMBULI**.

**NIGHTINGALE**, in ornithology. See **MOTACILLA**.

**NIGRITIA**. See **NEGROLAND**.

**NILE**, a great river in Egypt, having its source in Abyssinia, or the Upper Ethiopia, in  $12^{\circ}$  north lat. It generally runs from south to north through Abyssinia into Egypt, and then continues its course north in one stream till it comes below Cairo to the Delta, where it divides; one branch discharging itself into the Mediterranean at Damietta, and another a hundred miles to the westward of it at Rosetta. There are great rejoicings every year when the Nile rises to a certain height, their future harvest depending upon it. The just height of the inundation, according to Pliny, is sixteen cubits; when it arises but to twelve or thirteen, a famine is dreaded; and when it exceeds sixteen, there is also danger apprehended. The river begins usually to rise in May or June, and is conveyed by reservoirs, cisterns, and canals, to the fields and gardens as they want it.

As to the Delta, it is all overflowed.

**NIMBUS**, in antiquity, a circle observed on certain medals, or round the head of some emperors, answering to the circles of light, drawn around the images of saints.

**NIMEGUEN**, a city of the united Netherlands, situated on the river Waal, in the province of Guelderland, 52 miles south east of Amsterdam.

**NIMETULAHITES**, a kind of Turkish monks, so called from their founder Nimetulahi, famous for his doctrines and the austerities of his life.

**NIMPO**, a city and port town of China, in the province of Chekiang: E. long.  $122^{\circ}$ , N. lat.  $30^{\circ}$ .

**NINEVEH**, an ancient city of Assyria, was situated on the eastern banks of the river Tygris, opposite to the place where Moussul now stands.

**NINOVE**, a town of the Austrian Netherlands, in the province of Flanders, situated on the river Dender, thirteen miles west of Brussels.

**NIO**, a small Turkish island in the Archipelago, situated north-west of Santorini, remarkable for little but the tomb of Homer, who is said to lie buried here.

**NIORT**, a town of France, in the province of Orleans and territory of Poitou, situated on the river Seure, twenty eight miles north-east of Rochelle.

**NIPHON**, the largest of the Japan islands, situated in the Indian ocean about 130 miles east of China; being 600 miles long, and 150 broad, and containing 55 provinces.

**NIPPERS**, in the menage, are four teeth in the forepart of a horse's mouth, two in the upper and two in the lower jaw. A horse puts them forth between the second and third year.

**NIPPLES**, in anatomy. See **ANATOMY**, p. 277.

**NIPPLE WORT**, in botany. See **LAPSAÑA**.

**NISI PRIUS**, in law, a judicial writ which lies in cases where the jury being impannelled and returned before the justices of the bank one of the parties requests to have such a writ, for the ease of the country, in order that the trial may come before the justices in the same county on their coming thither. The purport of a writ of nisi prius is, that the sheriff is thereby commanded to bring to Westminster the men impannelled, at a certain day, before the justices, "nisi prius justiciarum domini regis ad assisas capiendas venerint."

**NISMES**, a fine city of France, in the province of Languedoc: E. long.  $4^{\circ} 26'$ , N. lat.  $43^{\circ} 40'$ .

**NISNA**, or **NISE-NOVOGOROD**, the capital of the province of Nise, or Little Novogorod, in Russia: E. long.  $45^{\circ}$ , N. lat.  $56^{\circ}$ .

**NISSA**, a city of European Turkey, in the province of Servia: E. long.  $23^{\circ}$ , N. lat.  $45^{\circ}$ .

**NISSA** or **NIZZA**, a town of Italy, in the duchy of Montserrat: E. long.  $8^{\circ} 40'$ , N. lat.  $44^{\circ} 45'$ .

**NITHSDALE**, a county of Scotland, bounded by Clydesdale on the north, by Annandale on the east, by Solway frith on the south, and by Galloway on the west.

**NITRACHT**, or **NYTREA**, a town of Hungary, forty miles north-east of Presburg.

**NITRE**, or **SALT-PETRE**. See **CHEMISTRY**, p. 73.

**NIUCHE**, a kingdom of Chinese Tartary, north of the province of Laotung.

**NIVELLE**, a town of the Austrian Netherlands, and province of Brabant, fourteen miles south of Brussels.

**NIXABOUR**, or **NISABOUR**, a city of Persia, in the province of Chorassan: E. long.  $57^{\circ} 32'$ , N. lat.  $35^{\circ} 40'$ .

**NOBILIARY**, in literary history, a book containing the history of the noble families of a nation, or province: such are Chorier's Nobiliary of Dauphine, and Caumartin's Nobiliary of Provence. The Germans are said to be particularly careful of their nobiliaries, in order to keep up the purity of their families.

**NOBILITY**, a quality that ennobles, and raises a person possessed of it above the rank of a commoner.

The origin of nobility in Europe is by some referred to the Goths; who, after they had seized a part of Europe, rewarded their captains with titles of honour, to distinguish them from the common people. In Britain the term nobility is restrained to degrees of dignity above knighthood; but every where else nobility and gentility are the same. The British nobility consists only of five degrees, *viz.* that of a duke, marquis, earl or count, viscount, and baron, each of which see under their proper articles.

**NOBLE**, a money of account containing six shillings and eight-pence.

The noble was anciently a real coin struck in the reign of Edward III. and then called the penny of gold; but it was afterwards called a rose-noble, from its being stamped with a rose: it was current at 6s. 8d.

**NOCERA**, a town of Italy, in the territory of the pope and duchy of Spoleto, twenty miles north-east of Spoleto.

**Terra NOCERIANA**, **EARTH OF NOCERA**, in the *materia medica*, a species of bole, remarkably heavy, of a greyish-white colour, of an insipid taste, and generally with some particles in it which grit between the teeth.

It is much esteemed, by the Italians, as a remedy for venomous bites, and in fevers; but, except its astringent quality, little dependence is to be had on the other virtues ascribed to it.

**NOCTAMBULI**, or **NIGHTWALKERS**, in medicine, a term applied to persons who have a habit of rising and walking about in their sleep.

**NOCTILUCA**, a species of phosphorus, so called because it shines in the night without any light being thrown upon it; such is the phosphorus made of urine. See **CHEMISTRY**, p. 123.

**NOCTURNAL**, something relating to the night, in contradistinction to diurnal.

**NOCTURNAL**, **NOCTURLABIUM**, an instrument chiefly used at sea, to take the altitude or depression of some stars about the pole, in order to find the latitude and hour of the night.

Some nocturnals are hemispheres, or planispheres, on the plane of the equinoctial. Those commonly in use among seamen are two; the one adapted to the polar star, and the first of the guards of the little bear; the other to the pole-star, and the pointers of the great bear.

This instrument consists of two circular plates, (Plate CXXXIV. fig. 2.) applied to each other. The greater, which has a handle to hold the instrument, is about  $2\frac{1}{2}$  inches diameter, and is divided into twelve parts, agreeing to the twelve months; and each month sub-divided into every fifth day; and so as that the middle of the handle corresponds to that day of the year wherein the star here regarded has the same right ascension with the sun. If the instrument be fitted for two stars, the handle is made moveable. The upper left circle is divided into twenty-four equal parts for the twenty four hours of the day, and each hour sub-divided into quarters. These twenty four hours are noted by twenty four teeth to be told in the night. Those at the hours 12, are distinguished by their length. In the centre of the two circular plates is adjusted a long index, A, moveable upon the upper plate. And the three pieces, *viz.* the two circles and index, are joined by a rivet which is pierced through the centre with a hole, through which the star is to be observed.

*To use the NOCTURNAL*, turn the upper plate till the long tooth, marked 12, be against the day of the month on the under plate: then, bringing the instrument near the eye, suspend it by the handle with the plane nearly parallel to the equinoctial; and viewing the pole-star through the hole of the centre, turn the index about, till, by the edge coming from the centre, you see the bright star or guard of the little bear (if the instrument be fitted to that star :) then that tooth of the upper circle, under the edge of the index, is at the hour of the night on the edge of the hour circle: which may be known without a light, by counting the teeth from the longest, which is for the hour 12.

**NODATED HYPERBOLA**, a name given by Sir Isaac Newton, to a kind of hyperbola, which, by turning round, decussates or crosses itself.

**NODE**, a tumour arising on the bones, and usually proceeding from some venereal cause; being much the same with what is otherwise called exostosis.

**NODES**. See **ASTRONOMY**, p. 477.

**NODUS**, or **NODE**, in dialling, a certain point or pole in the gnomon of a dial, by the shadow or light whereof either the hour of the day in dials without furniture, or the parallels of the sun's declination, and his place in the ecliptic, &c. in dials with furniture, are shewn. See **DIALLING**.

**NOETIANS**, in church history, Christian heretics in the III<sup>d</sup> century, followers of Noetius, a philosopher of Ephesus, who pretended that he was another Moses, sent by God; and that his brother was a new Aaron. His heresy consisted in affirming that there was but one person in the Godhead; and that the Word and the Holy Spirit were but external denominations, given to God, in consequence of different operations; that as Creator, he is called Father; as Incarnate, Son; and as descending on the apostles, Holy Ghost.

**NOGAIAN TARTARS**, a nation which inhabits that part of Circassia, in Asiatic Turkey, that lies between the Patus Meotis and the Caspian sea.

**NOGENT**, a town of France, in the province of Champagne, situated on the river Seine, twenty five miles north-west of Troyes.

**NOLA**,

**NOLA**, a town of Italy, in the kingdom of Naples, situated 16 miles east of Naples.

**NOLI**, a town of Italy in the territory of Genoa, situated on the bay of Genoa, thirty five miles south west of that city.

**NOMARCHA**, in Egyptian antiquity, the governor or commander of a nome. Egypt was anciently divided into several regions or quarters, called nomes.

**NOMBRE DE DIOS**, a town of Mexico, in the province of Darien, a little to the eastward of Porto Bello: W. long. 83°, and N. lat. 10°.

**NOMBRIL POINT**, in heraldry, is the next below the fess point, or the very centre of the escutcheon. See **POINT**.

Supposing the escutcheon divided into two equal parts below the fess, the first of these divisions is the nombril, and the lower the base.

**NOME**, or **NAME**, in algebra, denotes any quantity with a sign prefixed or added to it, whereby it is connected with some other quantity, upon which the whole becomes a binomial, trinomial, or the like. See **ALGEBRA**.

**NOMENCLATOR**, in Roman antiquity, was usually a slave, who attended upon persons that stood candidates for offices, and prompted or suggested to them the names of all the citizens they met, that they might court them, and call them by their names; which, among that people, was the highest piece of civility.

**NOMENCLATOIRES**, among the botanical authors, are those who have employed their labours about settling and adjusting the right names, synonymes, and etymologies of names, in regard to the whole vegetable world.

**NOMENCLATURE**, a catalogue of several of the more usual words in any language, with their significations, compiled in order to facilitate the use of such words to those who are to learn the tongue: such are our Latin, Greek, French, &c. nomenclatures.

**NOMINALS**, **NOMINALISTS**, a sect of school philosophers, the disciples and followers of Occam, or Ockham, an English cordelier, in the XIVth century. They were great dealers in words, whence they were vulgarly denominated word-sellers; but had the denomination of nominalists, because that, in opposition to the realists, they maintained that words, and not things, were the object of dialectics.

**NOMINATIVE**, in grammar, the first case of nouns which are declinable. See **GRAMMAR**.

**NONAGE**, in law, generally signifies all the time a person continues under the age of one and twenty; but in a special sense, it is all the time a person is under the age of fourteen.

**NON-CAPE**, in geography, a promontory on the west coast of Africa, opposite to the Canary islands.

**NON-ENTRY**, in Scots law. See **LAW**, Tit. xii. 5.

**NON-NATURALS**, in medicine, so called because by their abuse they become the causes of diseases.

Physicians have divided the non-naturals into six classes, viz. the air, meats and drinks, sleep and watching, motion and rest, the passions of the mind, the retentions and excretions.

**NON-SUIT**, signifies the dropping of a suit or action, or a renouncing thereof by the plaintiff or defendant.

**NONCONFORMISTS**. See **DISSENTERS**.

**NONE**, one of the seven canonical hours in the Romish church, answering to three o'clock in the afternoon.

**NONES**, in the Roman kalendar, the fifth day of the months January, February, April, June, August, September, November, and December; and the seventh of March, May, July, and October. March, May, July, and October, had six days in their nones; because these alone, in the ancient constitution of the year by Numa, had thirty-one days a-piece, the rest having only twenty-nine, and February thirty: but when Cæsar reformed the year, and made other-months contain thirty one days, he did not allot them six days of nones. See **KALENDAR**.

**NORDEN**, a port-town of Germany, in the circle of Westphalia, and county of Embden, twelve miles north of Embden.

**NORFOLK**, a county of England, bounded by the German sea on the north and east; by Suffolk on the south, and by the fens of Lincolnshire and the isle of Ely on the west.

**NORFOLK**, a county of Virginia, north of Carolina, and contiguous to that province.

**NORMANDY**, a province of France, bounded by the east channel on the north, by Picardy and the isle of France on the west, by Orleans on the south, by Britany and another part of the east channel on the west.

**NORROY**, the title of the third of the three kings-at arms.

**NORTH**, one of the four cardinal points. See **NAVIGATION**.

**NORTH CURRY**, a market-town of Somersetshire, seventeen miles south-west of Wells.

**NORTH FORELAND**, a cape in the isle of Thanet, on the east coast of Kent, four miles east of Margate.

**NORTH SEA**, a name given to all that part of the Atlantic Ocean which lies north of Terra Firma, in South America.

**NORTH-WEST passage**. A north-west passage by Hudson's Bay, into the pacific ocean, has been more than once attempted of late years, but hitherto without success. Some greatly doubt of the practicableness of such an enterprize, and think the observations made by the Russians give us small hopes. Some general things may be seen in the Phil. Trans. N<sup>o</sup> 482. sect. 14. It appears from thence, that the Russians have passed between the land of Nova Zembla, and the coast of Asia; and, as the Dutch did formerly discover the northern coasts of Nova Zembla, we may now be well assured that that country is really an island.

**NORTHALLERTON**, a borough-town of the north riding of Yorkshire, twenty-two miles north-west of York. It sends two members to parliament.

**NORTHAMPTON**, the capital of Northamptonshire, situated on the river Nen: W. long. 55', and N. lat. 52° 15'. It sends two members to parliament.

**NORTHAMPTON**, is also a county of Virginia, in North America,

- America, which forms the south part of the peninsula on the eastern shore of Virginia.
- NORTHAUSEN**, a town of Germany in the circle of Upper Saxony, and territory of Thuringia, fifty-five miles south-west of Magdeburg.
- NORTHLEECH**, a market town of Gloucestershire, fifteen miles east of Gloucester.
- NORTHUMBERLAND**, a county of England, bounded on the north by Scotland, on the east by the German sea, on the south by Durham, and on the west by Cumberland and part of Scotland.
- NORTHUMBERLAND** is also a county of Virginia, lying at the mouth of the river Patowmac.
- NORTHWICH**, a market town of Cheshire, sixteen miles north-east of Chester.
- NORWAY**, a kingdom of Europe, situated between  $4^{\circ}$  and  $30^{\circ}$  east longitude, and between  $58^{\circ}$  and  $72^{\circ}$  north latitude, bounded by the Atlantic ocean on the north and west, by Swedish Lapland and other provinces of Sweden on the east, and by the sea called the Cate-gate and Schaggeric on the south. It is a cold barren country, subject to Denmark.
- NORWAY-RAT**, in zoology. See **MUS**.
- NORWICH**, a large city of great trade in Norfolk, situated 20 miles west of Yarmouth and the German ocean: E. long.  $1^{\circ} 26'$ , and N. lat.  $52^{\circ} 40'$ . It sends two members to parliament.
- NOSE**, in anatomy. See **ANATOMY**, p. 161, 162, 163, 293.
- NOTARY**, signifies a person, usually some scrivener, who takes notes, or frames short draughts, of contracts, obligations, charter-parties, or other writings. At present we call him a notary-public who publicly attests deeds, or writings, in order to make them authentic in another nation: but he is principally employed in business concerning merchants, as making protests of bills of exchange &c. And noting a bill, is where he goes to take notice of a merchant's refusal to accept or pay the same.
- NOTATION**, in arithmetic. See **ARITHMETIC**, p. 366.
- NOTES**, in musick, characters which mark the sounds, *i. e.* the elevations and fallings of the voice, and the swiftness and slowness of its motions. See **MUSICK**.
- NOTE** is likewise used for a mark made in a book or writing where there occurs something remarkable and worthy of particular notice: as also for an observation or explication of some passage in an author added in the margin, at the bottom of the page, or elsewhere, in which sense it stands contradistinguished to text.
- NOTE**, is also a minute, or short writing, containing some article of business, in which sense we say, promissory note, note of hand, bank note, &c.
- NOTHUS**, signifies spurious or bastard; whence it is figuratively applied by physicians, &c. to such diseases as though in respect of a similitude of symptoms, &c. they have the same denomination as some others, yet are of a different origin, seat, or the like, from the same.
- NOTION**, in logic, an idea or representation of any thing in the mind. See **LOGIC** and **METAPHYSICS**.
- NOTITIA**, in literary history, a book that gives an account of a particular country, city, or other place: such is the Notitia Imperii Romani, Notitia Romæ Antiquæ, &c.
- NOTO**, the capital of a province of the same name in Sicily, twenty miles south of Syracuse, E. long.  $15^{\circ}$ , N. lat.  $37^{\circ} 15'$ .
- NOTONECTA**, the BOAT-FLY a genus of insects belonging to the order hemiptera. The beak is inflexed; the antennæ are shorter than the thorax; the four wings are plaited cross-ways; and the feet are hairy, and fitted for swimming. There are three species, distinguished by their colour.
- NOTTEBURG**, a city of Russia, situated on an island in the lake Lodoga, twenty five miles east of Peterburg.
- NOTTINGHAM**, the capital of Nottinghamshire, situated about a mile north of the river Trent; W. long.  $1^{\circ} 5'$ , N. lat.  $53^{\circ}$ . It sends two members to parliament.
- NOVA-SCOTIA**. See **SCOTLAND**.
- NOVA-ZEMBLA**, or Newland, called by the Dutch the island of Weygats, is situated in the frozen ocean, between  $50^{\circ}$  and  $80^{\circ}$  east longitude, and between  $70^{\circ}$  north latitude and the north pole: it is separated from the province of Samoida, in Russia, by the straits of Weygats.
- NOVARA**, the capital of the Novarese, in the duchy of Milan, forty miles west of Milan.
- NOVATIANS**, a Christian sect which sprang up in the third century, so called from Novatian a priest of Rome, or Novatus an African bishop who separated from the communion of pope Cornelius, whom Novatian charged with a criminal lenity towards those who had apostatized during the persecution of Decius. He denied the church's power of remitting mortal sins, upon the offender's repentance; and at last went so far as to deny that the apostles could ever hope for pardon even from God himself.
- NOVATION**, or **INNOVATION**, in the civil law, denotes the change of one kind of obligation for another; as when a promise is accepted instead of a written obligation.
- NOVATION**, in Scots law. See **LAW**, Tit. xxiii. 7.
- NOVEL**, in matters of literature, a fictitious history of a series of entertaining events in common life, wherein the rules of probability are or ought to be strictly preserved.
- NOVELLARA**, a town of Italy, in the duchy of Mantua, twenty miles south of the city of Mantua.
- NOVEMBER**, in chronology, the eleventh month of the Julian year, consisting only of thirty days; it got the name of November, as being the ninth month of Romulus's year, which began with March.
- NOVEMVIRI**, the nine magistrates of Athens, more usually called archons.
- NOVIGRAD**, a town of Dalmatia, in  $17^{\circ} 30'$  E. long. and  $44^{\circ} 30'$  N. lat.
- NOUN**, in grammar, a part of speech, which signifies things without any relation to time; as a man, a house, sweet, bitter, &c. See **GRAMMAR**.
- NOVOGOROD**, the capital of a province of the same name in Muscovy, situated on the river Wolcoss, 130 miles

miles south east of Petersburg; E. long. 34°, N. lat. 58°.

It is an archbishop's see, and has 180 churches and monasteries.

**NOVOGRODECK**, a city of Lithuania, in Poland: E. long. 25° 30', N. lat. 53° 45'.

**NOURISHMENT**. See **NUTRITION**.

**NOWED**, in heraldry, signifies knotted, from the Latin *nodatus*; being applied to the tails of such creatures as are very long, and sometimes represented in coat-armour, as if tied up in a knot.

**NUBIA**, a country of Africa, bounded by the desert of Barca, on the north; by Egypt and Abyssinia, on the east; by the Lower Ethiopia, on the south; and by the deserts of Africa, on the west.

**NUCHA**, the nape of the neck.

**NUCIFEROUS TREES**, such as bear nuts.

**NUCIFRAGA**, in ornithology. See **CORVUS**.

**NUCLEUS**, in general denotes the kernel of a nut, or even any seed inclosed within a husk.

The term nucleus is also used for the body of a comet, otherwise called its head. See **ASTRONOMY**, p. 444.

**NUDITIES**, in painting and sculpture, denotes those parts of an human figure which are not covered with any drapery; or those parts where the carnation appears.

**NULLITY**, in law, signifies anything that is null or void: thus there is a nullity of marriage, where persons marry within the degrees, or where infants marry without consent of their parents or guardians.

**NUMBER**. See **ARITHMETIC**.

**Golden NUMBER**. See **ASTRONOMY**, p. 495.

**NUMBER**, in grammar, a modification of nouns, verbs, &c. to accommodate them to the varieties in their objects, considered with regard to number. See **GRAMMAR**.

**NUMBERS**, in poetry. See **VERSIFICATION**.

**Book of NUMBERS**, the fourth book of the Pentateuch, taking its denomination from its numbering the families of Israel.

A great part of this book, is historical, relating to several remarkable passages in the Israelites march through the wilderness. It contains a distinct relation of their several movements from one place to another, or the two and forty stages through the wilderness, and many other things, whereby we are instructed and confirmed in some of the weightiest truths that have immediate reference to God and his providence in the world. But the greatest part of this book is spent in enumerating these laws and ordinances, whether civil or ceremonial, which were given to God, but not mentioned before in the preceding books.

**NOMENIUS**, in ornithology, a genus of birds of the order of the scelopaces; the beak of which is of a figure approaching to a cylindrical one; it is obtuse at the point, and is longer than the toes; the feet have each 4 toes, connected together. This genus comprehends the curlew, the woodcock, the great plover, and the snipe. See **CURLEW**, &c.

**NUMERAL LETTERS**, those letters of the alphabet

which are generally used for figures; as I, one; V, five; X, ten; L, fifty; C, a hundred; D, five hundred; M, a thousand; &c.

**NUMERATION**, or **NOTATION**, in arithmetic. See **ARITHMETIC**, p. 366.

**NUMERATOR** of a fraction. See **ARITHMETIC**, p. 387.

**NUMERICAL**, **NUMEROUS**, or **NUMERAL**, something belonging to numbers; as numerical algebra is that which makes use of numbers, instead of letters of the alphabet. Also, numerical difference, is the difference whereby one individual is distinguished from another. Hence a thing is said to be numerically the same, when it is so in the strictest sense of the word.

**NUMIDIA**, in ornithology, a genus belonging to the order of gallinæ. On each side of the head there is a kind of coloured fleshy horn; and the beak is furnished with cere near the nostrils. There is but one species, a native of Africa.

**NUMIDIA**, the ancient name of Biledulgerid, in Africa.

**NUMISMATOGRAPHIA**, a term used for the description and knowledge of ancient medals and coins, whether of gold, silver, or brass.

**NUMMUS**, among the Romans, a piece of money otherwise called sestertius.

**NUN**, a woman, in several Christian countries, who devotes herself, in a cloister or nunnery, to a religious life.

There were women in the ancient Christian church who made public profession of virginity before the monastic life was known in the world, as appears from the writings of Cyprian and Tertullian. These, for distinction's sake, are sometimes called ecclesiastical virgins, and were commonly enrolled in the canon or matricula of the church. They differed from the monastic virgin chiefly in this, that they lived privately in their father's houses, whereas the others lived in communities: but their profession of virginity was not so strict as to make it criminal in them to marry afterwards if they thought fit. As to the consecration of virgins, it had some things peculiar in it; it was usually performed publicly in the church by the bishop. The virgin made a public profession of her resolution, and then the bishop put upon her the accustomed habit of sacred virgins. One part of this habit was a veil, called the sacrum velamen; another was a kind of mitre or coronet worn upon the head. At present, when a woman is to be made a nun, the habit, veil, and ring of the candidate are carried to the altar; and she herself, accompanied by her nearest relations, is conducted to the bishop, who, after mass and an anthem, the subject of which is, "that she ought to have her lamp lighted, because the bridegroom is coming to meet her," pronounces the benediction: then she rises up, and the bishop consecrates the new habit, sprinkling it with holy water. When the candidate has put on her religious habit, she presents herself before the bishop, and sings on her knees, *Ancilla Christi sum*, &c. then she receives the veil, and afterwards the ring, by which she is married to Christ; and lastly the crown of virginity.

ginity. When she is crowned, an anathema is denounced against all who shall attempt to make her break her vows.

**NUNCIO**, or **NUNTIO**, an ambassador from the pope to some catholic prince or state; or a person who attends on the pope's behalf at a congress, or an assembly of several ambassadors.

**NUNCUPATIVE**, in the schools, something that is only nominal, or has no existence but in name.

**NUNCUPATIVE TESTAMENT**, in Scots law. See *LAW*, Tit. xxviii. 2.

**NUNDINAL**, **NUNDINALIS**, a name which the Romans gave to the eight first letters of the alphabet, used in their kalendar.

This series of letters, A, B, C, D, E, F, G, H, is placed and repeated successively from the first to the last day of the year: one of these always expressed the market days, or the assemblies called *nundinae*, *quasi novendinae*, because they returned every nine days. The country people, after working eight days successively, come to town the ninth, to sell their several commodities, and to inform themselves of what related to religion and government. Thus the nundinal day being under A on the first, ninth, seventeenth, and twenty fifth days of January, &c. the letter day will be the nundinal letter of the year following. These nundinals bear a very great resemblance to the dominical letters, which return every eight days, as the nundinals did every nine.

**NUPTIAL RITES**, the ceremonies attending the solemnization of marriage, which are different in different ages and countries.

**NURENBURG**, the capital of a territory of the same name, in the circle of Franconia, in Germany: E. long. 11°, N. lat. 49° 30'.

**NURSERY**, in gardening, is a piece of land set apart for raising and propagating all sorts of trees and plants, to supply the garden and other plantations. See *GARDENING*.

**NUSANCE**, in law, a thing done to the annoyance of another.

Nuances are either public or private. A public nuisance is an offence against the public in general, either by doing what tends to the annoyance of all the king's subjects, or by neglecting to do what the common good requires: in which case all annoyances and injuries to streets, high-ways, bridges, and large rivers, as also disorderly ale houses, bawdy-houses, gaming-houses, stages for rope-dancers, &c. are held to be common nuisances. A private nuisance is when only one person or family is annoyed, by the doing of any thing; as where a person stops up the light of another's house, or builds in such a manner that the rain falls from his house upon his neighbour's.

**NUT**, among botanists, denotes a pericarpium of an extraordinary hardness, inclosing a kernel or seed.

**NUTATION**, in astronomy, a kind of tremulous motion of the axis of the earth, whereby, in each annual revolution, it is twice inclined to the ecliptic, and as often returns to its former position.

**NUTMEG**, the kernel of a large fruit, not unlike the peach.

The nutmeg is separated from its investient coat, the mace, before it is sent over to us; except that the whole fruit is sometimes imported in preserve, by way of sweetmeat, or as a curiosity. See *MACE*.

The nutmeg, as we receive it, is of a roundish or oval figure, of a tolerably compact and firm texture, but easily cut with a knife, and falling to pieces on a smart blow. Its surface is not smooth, but furrowed with a number of wrinkles, running in various directions, though principally longitudinally. It is of a greyish brown colour on the outside, and of a beautiful variegated hue within, being marbled with brown and yellow variegations, running in perfect irregularity through its whole substance. It is very unctuous and fatty to the touch, when powdered; and is of an extremely agreeable smell, and of an aromatic taste.

There are two kinds of nutmeg in the shops, the one called by authors the male, and the other the female. The female is the kind in common use, and is of the shape of an olive: the male is long and cylindrical, and has less of the fine aromatic flavour than the other; so that it is much less esteemed, and people who trade largely in nutmegs will seldom buy it. The longer male nutmeg, as we term it, is called by the Dutch the wild nutmeg. It is always distinguishable from the others, as well by its want of fragrance, as by its shape: it is very subject to be worm-eaten, and is strictly forbid, by the Dutch, to be packed up among the other, because it will give occasion to their being worm-eaten too, by the insects getting from it into them, and breeding in all parts of the parcel.

The largest, heaviest, and most unctuous of the nutmegs are to be chosen, such as are of the shape of an olive, and of the most fragrant smell. The Dutch import them from the East-Indies.

Nutmeg is greatly used in our foods, and is of excellent virtues as a medicine; it is a good stomachic, it promotes digestion, and strengthens the stomach. It also stops vomiting; is an excellent remedy in flatulencies; and is happily joined with rhubarb, and other medicines, in diarrhoeas. It is observed to have a soporific virtue, and to exert it too strongly, if taken in immoderate quantities. It has a considerable degree of astringency; and given, after toasting before the fire till thoroughly dry and crumbly, it has been sometimes known alone to cure diarrhoeas.

**NUTRITION**, in the animal œconomy, is the repairing the continual loss, which the different parts of the body undergo. The motion of the parts of the body, the friction of these parts with each other, and especially the action of the air, would destroy the body entirely, if the loss was not repaired by a proper diet, containing nutritive juices; which being digested in the stomach, and afterwards converted into chyle, mix with the blood, and are distributed through the whole body for its nutrition.

In young persons, the nutritive juices not only serve to repair the parts that are damaged, but also to increase them, which is called growth.

In grown persons, the cuticle is every where constantly desquamating, and again renewing; and in the same manner the parts rubbed off, or otherwise separated

rated from the fleshy parts of the body, are soon supplied with new flesh; a wound heals, and an emaciated person grows plump and fat.

Buffon, in order to account for nutrition, supposes the body of an animal, or vegetable, to be a kind of mould, in which the matter necessary to its nutrition is modelled and assimilated to the whole. But, continues he, of what nature is this matter, which an animal, or vegetable, assimilates to its own substance? What power is it that communicates to this matter the activity and motion necessary to penetrate this mould? and, if such a force exist, would it not be by a similar force that the internal mould itself might be reproduced?

As to the first question, he supposes that there exists in nature an infinite number of living organical parts, and that all organized bodies consist of such organical parts; that their production costs nature nothing, since their existence is constant and invariable; so that the matter which the animal, or vegetable, assimilates to its substance, is an organical matter, of the same nature with that of the animal, or vegetable, which consequently may augment its volume, without changing its form, or altering the quality of the substance in the mould.

As to the second question: There exist, says he, in nature, certain powers, as that of gravity, that have no affinity with the external qualities of the body, but act upon the most intimate parts, and penetrate them throughout, and which can never fall under the observation of our senses.

And, as to the third question, he answers, that the internal mould itself is reproduced, not only by a similar power, but it is plain that it is the very same power that causes the unfolding and reproduction thereof: for it is sufficient, proceeds he, that in an organized body that unfolds itself, there be some part similar to the whole, in order that this part may one day become itself an organized body, altogether like that of which it is actually a part.

NUX PISTACHIA. See PISTACHIA.

NUYS, a town of Germany, twenty miles north of Cologne.

NYBURG, a town of Denmark, situated at the east-

end of the island of Funen, ten miles east of Odensee: E. long. 10°, N. lat. 55° 30'.

NYCTHEMERON, the natural day, or day and night, which together always make twenty-four hours.

NYCTALOPIA, in medicine, a two-fold disorder of the eye, one of which is opposite to the other. In the first, the sight is best in the night, and in obscure places; whereas in a clear light their sight fails, so that they can hardly see any thing. In the other sort of nyctyopia, the patient can see nothing at all except in a clear and bright light.

NYCTANTHES, *Arabian JASMINE*, in botany, a genus of the diandria monogynia class. The calix and likewise the corolla consist of eight segments. There are five species, none of them natives of Britain.

NYCTICORAX, in ornithology. See ARDEA.

NYLAND, a province of Finland, situated on the gulph of Finland, west of the province of Carelia.

NYMPH, in mythology, an appellation given to certain inferior goddesses inhabiting the mountains, woods, waters, &c. See MYTHOLOGY.

НУМРН, among naturalists, that state of winged insects between their living in the form of a worm, and their appearing in the winged or most perfect state.

НУМРНѦ, in anatomy. See ANATOMY, p. 276.

NYMPHÆA, the WATER-LILY, in botany, a genus of the polyandria monogynia class. The corolla consists of many petals, and the calix of four or five leaves; and the berry has many cells. There are four species, two of which are natives of Britain, viz. the lutea, or yellow water-lily; and the alba, or white water-lily.

NYMPHEUM, in antiquity, a public hall, magnificently decorated, for entertainment, &c. and where those who wanted convenience at home held their marriage-feasts, whence the name.

NYONS, a town of Dauphiné, in France: E. long. 5° 6', N. lat. 44° 28'.

NYSLÖT, a town of Sweden in the province of Finland, sixty miles north of Wyburg: E. long. 29°, N. lat. 62°.



O.

O A K

OAK, in botany. See QUERCUS.

OAK of Jerusalem, in botany. See CHENOPODIUM.

OAKAM, old ropes untwisted, and pulled out into loose hemp, in order to be used in caulking the seams, tree-nails, and beads of a ship, for stopping or preventing leaks.

OAKHAMPTON, a borough of Devonshire, twenty

O A R

miles west of Exter, which sends two members to parliament.

OAR, in navigation, a long piece of wood, made round where it is to be held in the hand, and thin and broad at the other end, for the easier cutting and resisting the water, and consequently moving the vessel, by rowing. Oars for ships are generally cut out of fir-timber; those for barges are made out of New-England, or Dantzick-

- rafters; and those for boats either out of English ash, or fir-rafters from Norway.
- OAT**, in botany. See **AVENA**.
- OATH**, is a solemn affirmation, in which the persons sworn invoke the Almighty to witness that their testimony is true; renouncing all claim to his mercy, and calling for his vengeance, if it be false.
- OBADIAH**, or *the Prophecy of OBADIAH*, a canonical book of the Old Testament, which is contained in one single chapter; and is partly an invective against the cruelty of the Edomites, who mocked and derided the children of Israel; as they passed into captivity, and with other enemies, their confederates, invaded and oppressed those strangers, and divided the spoil amongst themselves; and partly a prediction of the deliverance of Israel, and of the victory and triumph of the whole church over her enemies.
- OBELISK**, in architecture; a truncated, quadrangular, and slender pyramid, raised as an ornament, and frequently charged either with inscriptions or hieroglyphics.
- Obelisks appear to be of very great antiquity, and to be first raised to transmit to posterity precepts of philosophy, which were cut in hieroglyphical characters: afterwards they were used to immortalize the great actions of heroes, and the memory of persons beloved. The first obelisk mentioned in history was that of Ramesses king of Egypt, in the time of the Trojan war, which was forty cubits high. Ptolemy, another king of Egypt, raised one of forty-five cubits; and Ptolemy Philadelphus, another of eighty-eight cubits, in memory of Arsinoe. Augustus erected one at Rome in the Campus Martius, which served to mark the hours on an horizontal dial, drawn on the pavement. They were called by the Egyptian priests the fingers of the sun, because they were made in Egypt also to serve as styles or gnomons to mark the hours on the ground. The Arabs still call them Pharaoh's needles: whence the Italians call them *aguglia*, and the French *aiguilles*.
- OBERSTEIN**, the capital of the county of the same name, in the Palatinate of the Rhine, thirty miles east of Triers.
- OBERWESEL**, or **WESEL**, a town of Germany, in the electorate of Triers, thirty-seven miles north-east of the city of Triers.
- OBJECT**, in philosophy, something apprehended, or presented to the mind, by sensation or by imagination. See **METAPHYSICS**.
- OBJECT-GLASS** of a telescope. See **OPTICS**.
- OBJECTION**, something urged to overthrow a position, or a difficulty raised against an allegation or proposition of a person we are disputing withal.
- OBJECTIVE** is used, in the schools, in speaking of a thing which exists no otherwise than as an object known. The existence of such a thing is said to be objective.
- OBLATI**, in church history, were secular persons, who devoted themselves and their estates to some monastery, into which they were admitted as a kind of lay brothers. The form of their admission, was, putting the bell-
- ropes of the church round their necks, as a mark of servitude. They wore a religious habit, but different from that of the monks.
- OBLATION**, a sacrifice, or offering made to God.
- OBLIGATION**, in Scots law. See **LAW Tit. xx**.
- OBLIQUE**, in geometry, something assant, or that deviates from the perpendicular. Thus an oblique angle is either an acute or obtuse one, *i. e.* any angle except a right one.
- OBLIQUE CASES**, in grammar, are all the cases except the nominative.
- OBLIQUE LINE**, that which falling 'on another line, makes oblique angles with it, *viz.* one acute, and the other obtuse.
- OBLIQUE PLANES**, in dialling, are those which recline from the zenith, or incline towards the horizon. See **DIALLING**.
- OBLIQUE SAILING**, in navigation. See **NAVIGATION**.
- OBLIQUITY** of the ecliptic. See **ASTRONOMY**.
- OBLIQUUS**, in anatomy, a name given to several muscles, particularly in the head, eyes, and abdomen. See **ANATOMY**, Part II.
- OBLONG**, in general, denotes a figure that is longer than broad: such is a parallelogram, ellipsis, &c.
- OBOLUS**, in antiquity, an ancient Athenian coin. Among ancient physicians, obolus likewise denoted a weight, equal to ten grains.
- OBREPITIIOUS**, an appellation given to letters patent, or other instruments, obtained of a superior by surprise, or by concealing from him the truth.
- OBSCURE** something that is dark and reflects little light, or that is not clear and intelligible.
- OBSECRATION**, in rhetoric, a figure whereby the orator implores the assistance of God, or man.
- OBSEQUIES**, the same with funeral solemnities. See **FUNERAL**.
- OBSERVATION**, among navigators, signifies the taking the sun's or the star's meridian altitude, in order thereby to find the latitude.
- OBSERVATORY**, a place destined for observing the heavenly bodies; being generally a building erected on some eminence, covered with a terrace for making astronomical observations.
- The more celebrated observatories are, 1. The Greenwich-observatory, built in 1676, by order of Charles II. at the solicitations of Sir Jonas Moor and Sir Christopher Wren; and furnished with the most accurate instruments, particularly a noble sextant of seven feet radius, with telescopic sights.
2. The parish-observatory, built by the late Louis XIV. in the Faubourg St. Jacques. It is a very singular, but withal a very magnificent building; the design of monsieur Perault: It is eighty feet high; and at top is a terrace.
- The difference in longitude between this and the Greenwich observatory is 2° 20' west.
- In it is a cave, or cellar, 170 feet descent, for experiments that are to be made far from the sun; &c. particularly such as relate to congelations, refrigerations, indurations, conservations, &c.
3. Tycho Brahe's observatory, which was in the little

little island Ween, or Scarlet island, between the coasts of Schonen and Zeland, in the Baltic.

It was erected and furnished with instruments at his own expence, and called by him Uraniburg.

Here he spent twenty years in observing the stars: the result is his catalogue.

4. Pekin observatory. Father Le Compte describes a very magnificent observatory, erected and furnished by the late emperor of China, in his capital, at the intercession of some Jesuits, missionaries, chiefly father Verbiest, whom he made his chief observer.

The instruments are exceedingly large; but the divisions less accurate, and the contrivance in some respects less commodious than those of the Europeans: the chief are, an armillary, zodiacal sphere, of six Paris feet diameter; an equinoctial sphere, of six feet diameter; an azimuthal horizon, six feet diameter; a large quadrant, six feet radius; a sextant, eight feet radius; and a celestial globe, six feet diameter.

**OBSTRUCTION**, in medicine, such an obturation of the vessels, as prevents the circulation of the fluids, whether of the sound and vital, or of the morbid and peccant kind, through them.

**OBTURATOR**, in anatomy. See **ANATOMY**, p 205.

**OBTUSE**, signifies blunt, dull, &c. in opposition to acute, sharp, &c. thus we say obtuse angle, obtuse-angled triangle, &c.

**OBULARIA**, in botany, a genus of the didynamia angiospermia class. The calix has two segments; the corolla is campanulated, and divided into four segments; the capsule has one cell, two valves, and many seeds. There is but one species, a native of Virginia.

**OBY**, a great river of Russia, which rises in Kalmuck Tartary, and forms the boundary between Europe and Asia, till it falls into the frozen ocean, after it has run a course of above two thousand miles.

**OCCIDENT**, in geography, the westward quarter of the horizon, or that part of the horizon where the ecliptic, or the sun therein, descends into the lower hemisphere, in contradistinction to orient. Hence we use the word occidental, for any thing belonging to the west: as, occidental bezoard, occidental pearl, &c.

**OCCIPITAL**, in anatomy, a term applied to the parts of the occiput, or back part of the skull. See **ANATOMY**.

**OCCIPITIS** os, the **OCCIPITAL BONE**, in anatomy. See **ANATOMY**, p. 156.

**OCCULT**, something secret, hidden, or invisible. The occult sciences, are magic, necromancy, cabbala, &c.

**OCCULT**, in geometry, is used for a line that is scarce perceivable, drawn with the point of the compasses, or a leaden pencil. These lines are used in several operations, as the raising of plans, designs of building, pieces of perspective, &c. They are to be effaced when the work is finished.

**OCCULTATION**, in astronomy, the time a star or planet is hid from our sight, by the interposition of the body of the moon, or of some other planet. See **ASTRONOMY**.

**OCCUPANT**, in law, the person that first seizes, or gets possession of a thing.

**OCCUPATION**, in a legal sense, is taken for use or tenure; as in deeds it is frequently said, that such lands are or lately were in the tenure or occupation of such a person. It is likewise used for a trade or mystery.

**OCCUPIERS** of **WALLING**, a term in the salt-works for the persons who are the sworn officers that allot in particular places what quantity of salt is to be made, that the markets may not be overlooked, and see that all is carried fairly and equally between the lord and the tenant.

**OCEAN**, in geography, that vast collection of salt and navigable waters, in which the two continents, the first including Europe, Asia, and Africa, and the last America, are inclosed like islands.

**OCHLOCRACY**, that form of government wherein the populace has the chief administration of affairs.

**OCHNA**, in botany, a genus of the polyandria monogynia class. The corolla consists of five petals, and the calix of five leaves; and the berry contains one seed. There are two species, both natives of the Indies.

**OCHRE**, in natural history, a genus of earths, slightly coherent, and composed of fine, smooth, soft, argillaceous particles, rough to the touch, and readily diffusible in water.

Ochres are of various colours, as red, yellow, blue, brown, green, &c.

**OCYIMUM**, in botany, a genus of the didynamia gymnospermia class. The superior lip of the calix is round, and the inferior is divided into four segments. There are eight species, none of them natives of Britain.

**OCKER**, a river of Germany, which, rising in the southern part of the duchy of Brunswick, runs north; and passing by Wolfembutte and Brunswick, falls into the river Aller.

**OCKINGHAM**, a market-town of Berkshire, seven miles east of Reading.

**OCTAETERIDES**, in chronology, denotes a cycle of eight years, at the end of which three entire lunar months were added.

This cycle was in use at Athens, till Meton discovered the golden number.

**OCTAGON**, or **OCTOGON**, in geometry, is a figure of eight sides and angles; and this, when all the sides and angles are equal, is called a regular octagon, or one which may be inscribed in a circle.

**OCTAGON**, in fortification, denotes a place that has eight bastions. See **FORTIFICATION**.

**OCTAHEDRON**, or **OCTAEDRON**, in geometry, one of the five regular bodies, consisting of eight equal and equilateral triangles.

**OCTANDRIA**, in botany, one of the classes of plants established by Linnæus, the eighth in order. See **BOTANY**.

**OCTANT**, or **OCTILE**, in astronomy, that aspect of two planets, wherein they are distant an eighth part of a circle, or 45° from each other.

**OCTAPLA**, in matters of sacred literature, denotes a polyglot bible, consisting of eight columns, and as many different versions of the sacred text; viz. the original

original

- ginal Hebrew both in Hebrew and Greek characters, Greek versions, &c.
- OCTATEUCH**, an appellation given to the eight first books of the Old Testament.
- OCTAVE**, in music, an harmonical interval, consisting of seven degrees, or lesser intervals. See **MUSIC**.
- OCTOBER**, in chronology, the tenth month of the Julian year, consisting of thirty-one days: it obtained the name of October from its being the eighth month in the kalendar of Romulus.
- OCTOSTYLE**, in the ancient architecture, is the face of an edifice adorned with eight columns.
- OCULUS**, the eye, in anatomy. See **ANATOMY**, p. 289.
- OCULUS BELI**, in natural history, one of the semi-pellucid gems, of a greyish white colour, variegated with yellow, and with a black central nucleus: it is of a roundish form, and its variegations very beautifully represent the pupil and iris of the eye; whence the name.
- OCULUS MUNDI**, one of the semi-pellucid gems, of a whitish grey colour, without any variegations.
- OCZAKOW**, a port-town of European Turkey, the capital of Budziac Tartary: E. long. 35°, N. lat. 46°.
- ODA**, in the Turkish language, signifies a class, order, or chamber. The grand seignior's pages are divided into five classes or chambers. The first, which is the lowest in dignity, is called the great oda, from the great number of persons that compose it: these are the juniors, who are taught to read, write, and speak the languages. The second, is called the little oda; where from the age of fourteen or fifteen years, till about twenty, they are trained up to arms, and the study of all the polite learning the Turks are acquainted with. The third chamber, called kilar oda, consists of two hundred pages, which, besides their other exercises, are under the command of the kilardgi-bachi, and serve in the pantry and fruitery. The fourth consists only of twenty four, who are under the command of the khazineda-bachi, and have charge of the treasure in the grand seignior's apartment, which they never enter with cloaths that have pockets. The fifth is called kas-oda, or privy-chamber, and is composed of only forty pages, who attend in the prince's chamber. Every night eight of these pages keep guard in the grand seignior's bed chamber, while he sleeps: they take care that the light, which is constantly kept in the room, does not glare in his eyes, lest it should awake him; and if they find him disturbed with troublesome dreams, they cause him to be awaked by one of their agas.
- ODA BACHI**, or **ODDOBASSI**, among the Turks, an officer equivalent to a serjeant or corporal among us.
- ODE**, in poetry, a song, or a composition proper to be sung.

Among the ancients, odes signified no more than songs; but with us they are very different things. The ancient odes were generally composed in honour of their gods, as many of those of Pindar and Horace.

These had originally but one stanza, or strophe; but afterwards they were divided into three parts, the

strophe, the antistrophe, and the epode. The priests going round the altar singing the praises of the gods, called the first entrance, when they turned to the left, the strophe; the second, turning to the right, they called antistrophe, or returning; and, lastly, standing before the altar, they sung the remainder, which they called the epode.

Heroes and triumphs were also subjects for the ode; and in course of time love and entertainments were likewise thought very suitable to it. Here Anacreon and Sappho excelled, and Horace has left us some of both sorts wrote with peculiar sweetness and elegance. Among the moderns, Dryden's ode on St Cecilia's day, and Pope's on the same subject, are justly allowed to exceed every thing of the kind, either in this, or in any of the modern languages.

**ODENSEE**, the capital of Funen, one of the largest of the Danish islands in the Baltic, situated seventy-two miles west of Copenhagen.

**ODER**, a river which rises in the Carpathian mountains, on the confines of Hungary; runs through Silesia and Brandenburg; and then separating the eastern from the western Pomerania, divides itself into several channels, and falls into the Baltic sea.

**ODER** is also a town of Silesia, situated on the river of the same name: E. long. 17° 17', N. lat. 49° 45'.

**ODERBERG**, a town in the duchy of Silesia, in Bohemia, situated on the river Oder: E. long. 17° 45', N. lat. 50° 6'.

**ODERNHEIM**, a town of Germany, in the palatinate of the Rhine, fifteen miles south of Mentz.

**ODEUM**, in Grecian antiquity, a music-theatre, built by Pericles, the inside of which was filled with seats and ranges of pillars; and on the outside the roof descended shelving downwards from a point in the centre, with many bendings, in imitation of the king of Persia's pavilion. Here the musical prizes were contended for; and here also, according to Aristophanes, was a tribunal.

**ODIHAM**, a market-town of Hampshire, twenty miles north-east of Winchester.

**ODONTALGIA**, the **TOOTH ACH**, in medicine. See **MEDICINE**.

**ODONTOIDE**, in anatomy, an appellation given to a process of the second vertebra of the neck, from its resemblance to a tooth.

**ODOROUS**, or **ODORIFEROUS**, appellations given to whatever smells strongly, whether they be fetid or agreeable; but chiefly to things whose smell is brisk, and agreeable.

**ODYSSEY**, a celebrated epic poem of Homer, wherein are related the adventures of Ulysses in his return from the siege of Troy.

**OECONOMICS**, the art of managing the affairs of a family, or community; and hence the person who takes care of the revenues and other affairs of churches, monasteries, and the like, is termed oeconomus.

**OECONOMY**, denotes the prudent conduct, or discreet and frugal management, whether of a man's own estate, or that of another.

*Animal* **OECONOMY**, comprehends the various operations of

- of nature, in the generation, nutrition, and preservation of animals. See GENERATION, NUTRITION, &c.
- The doctrine of the animal oeconomy is nearly connected with physiology, which explains the several parts of the human body, their structure, use, &c. See ANATOMY.
- OECUMENICAL**, signifies the same with general, or universal; as oecumenical council, bishop, &c.
- OEDEMA**, in medicine and surgery. See MEDICINE and SURGERY.
- OEDENBURG**, or **EDENBURG**, a town of Hungary, thirty miles south of Vienna.
- OELAND**, a Swedish island in the Baltic sea, between the continent of Gothland, and the isle of Gothland: E. long. 16°, N. lat. between 56° and 57° 30'.
- OELFELD**, a town in the duchy of Magdeburg and circle of Lower Saxony in Germany, twenty miles east of Brunsvick.
- OENANTHE**, in botany, a genus of the pentandria digynia class. The stilocles are sessile, dissimilar, and barren in the disk; and the fruit is crowned with a calix. There are five species, three of them natives of Britain, *viz.* the fistulosa, or water-dropwort; the pimpinelloides, or pimpinell-dropwort; and the crocata, or yellow dropwort.
- OENANTHE**, in ornithology, a species of motacilla. See MOTACILLA.
- OENAS**. See COLUMBA.
- OENOPTÆ**, in Grecian antiquity, a kind of censors at Athens, who regulated entertainments, and took care that none drank too much or too little.
- OENOTHERA**, in botany, a genus of the octandria monogynia class. The calix consists of four segments, and the corolla of four petals; the capsule is cylindrical, and the seeds are naked. There are seven species, none of them natives of Britain.
- OESEL**, an island at the entrance of the bay of Livonia, in the Baltic sea; situated in 22° of E. long. and 58° of N. lat.
- OESOPHAGUS**, in anatomy. See ANATOMY, p. 282.
- OESTRUS**, in zoology, a genus of insects belonging to the order of diptera. It has no mouth, but the point appears in place of it, without any proboscis or snout. There are five species, distinguished by their colour.
- OETING**, the capital of the county of the same name, in the circle of Swabia, in Germany: E. long. 10° 25', and N. lat. 49'.
- OFFENBURG**, a free imperial city of the circle of Swabia, in Germany, situated on the river Kintzig: E. long. 7° 40', and N. lat. 48° 30'.
- OFFENCE** in law, an act committed against the law, or omitted where the law requires it.
- OFFICE**, a particular charge or trust, or a dignity attended with a public function. The word is primarily used in speaking of the offices of judicature and policy; as the office of a secretary of state, the office of a sheriff, of a justice of peace, &c.
- OFFICE** also signifies a place or apartment appointed for officers to attend in, in order to discharge their respective duties and employments: as the secretary's office, office of ordnance, excise-office, signet office, paper-office, pipe-office, fix-clerks office, &c.
- OFFICE**, in architecture, denotes all the apartments appointed for the necessary occasions of a palace or great house, as kitchens, pantries, confectionaries, &c.
- OFFICE**, in the canon-law, is used for a benefice that has no jurisdiction annexed to it.
- OFFICER**, a person possessed of a post or office. See the preceding article.
- Commission-OFFICERS**, are those appointed by the king's commission: such are all from the general to the cornet inclusive, who are thus denominated in contradistinction to warrant-officers, who are appointed by the colonel's or captain's warrant, as quarter-masters, serjeants, corporals, and even chaplains and surgeons.
- Field OFFICERS** are such as command a whole regiment, as the colonel, lieutenant-colonel, and major.
- Flag OFFICERS**. See FLAG-OFFICERS, and ADMIRAL.
- General-OFFICERS** are those whose command is not limited to a single company, troop, or regiment; but extends to a body of forces, composed of several regiments; such are the general, lieutenant-general, major-generals, and brigadiers.
- OFFICERS of the household**. See HOUSEHOLD.
- Staff-OFFICERS** are such as, in the king's presence, bear a white staff, or wand; and at other times, on their going abroad, have it carried before them by a footman bare-headed: such are the lord steward, lord chamberlain, lord treasurer, &c.
- The white staff is taken for a commission, and at the king's death each of these officers breaks his staff over the hearse made for the king's body, and by this means lays down his commission, and discharges all his inferior officers.
- Subaltern-OFFICERS** are all who administer justice in the name of subjects; as those who act under the earl marshal, admiral, &c. In the army, the subaltern officers are the lieutenants, cornets, ensigns, serjeants, and corporals.
- OFFICIAL**, in the canon-law, an ecclesiastical judge, appointed by a bishop, chapter, abbot, &c. with charge of the spiritual jurisdiction of the diocese.
- OFFICIAL**, is also a deputy appointed by an archdeacon, as his assistant, who sits as judge in the archdeacon's court.
- OFFICINAL**, in pharmacy, an appellation given to such medicines, whether simple or compound, as are required to be constantly kept in the apothecaries shops.
- OFFIDA**, a town of Italy subject to the pope, twenty-six miles south of Loretto.
- OFFING**, or **OFFIN**, in the sea language, that part of the sea a good distance from shore, where there is deep water, and no need of a pilot to conduct the ship: thus, if a ship from shore be seen sailing out to seaward, they say, she stands for the offing: and if a ship having the shore near her, have another a good way without her, or towards the sea, they say, that ship is in the offing.
- OFF-SETS**, in gardening, are the young shoots, that

- spring from the roots of plants; which being carefully separated, and planted in a proper soil, serve to propagate the species.
- OFF SETS**, in surveying, are perpendiculars let fall, and measuring from the stationary lines to the hedge, fence, or extremity of an enclosure.
- OGEE**, or **O. G.** in architecture, a moulding consisting of two members, the one concave, and the other convex; or of a round and a hollow, like an S. See **ARCHITECTURE**.
- OGIVE**, in architecture, an arch, or branch of a gothic vault; which, instead of being circular, passes diagonally from one angle to another, and forms a cross with the other arches.
- OGLIO**, a river which rises in the alps, in the county of Trent, and, after running southward, through the lake Ico and duchy of Mantua, falls into the Po a little west of Borgoforte.
- OHIO**, a large river of North America, which, taking its rise in the mountains of Pennsylvania, runs south-west; and, after receiving many considerable branches, falls into the Mississippi.
- OIL**. See **CHEMISTRY**, p. 92, &c.
- OINTMENT**, in pharmacy. See **UNGUENT**.
- OSIANS**, a town of France, in the province of Dauphiné, eighteen miles south-east of Grenoble.
- OSKHAM**, the capital of Rutlandshire, fourteen miles east of Leicester: W. long. 45', and N. lat. 52° 40'.
- OLAX**, in botany, a genus of the triandria monogynia class. The corolla is entire; the calix is funnel-shaped, and divided into three segments; and the nectarium consists of four leaves. There is but one species, a native of Ceylon.
- OLDENBURG**, the capital of the county of the same name in Westphalia: E. long. 7° 32', and N. lat. 53° 35'.
- OLDENDORP**, a town of Germany in the circle of Westphalia, thirty miles south-west of Hanover.
- OLDENLANDIA**, a genus of the tetrandria monogynia class. The corolla consists of four leaves, and the calix of four segments; and the capsule has two cells, and many seeds. There are four species, none of them natives of Britain.
- OLDENZEL**, a city of the United Netherlands, in the province of Overysseel: E. long. 6° 50', and N. lat. 52° 30'.
- OLD-WIFE-FISH**. See **BALISTES**.
- OLEA**, in botany, a genus of the diandria monogynia class. The corolla has four segments, with oval laciniæ; and the drupa contains one seed. There are two species.
- This tree grows in the southern parts of France, in Spain, Italy, and other warm countries: with us it is usually preserved in the green-houses of the curious; though it will bear our ordinary winters in the open air, and produce very good fruit. Olives have an acrid, bitter, extremely disagreeable taste: pickled (as we receive them from abroad) they prove less disagreeable. The Lucca olives, which are smaller than the others, have the weakest taste; the Spanish, or larger, the strongest; the Provence, which are of a middling size, are generally the most esteemed.
- The oil obtained from this fruit has no particular taste or smell, and does not greatly differ in quality from oil of almonds. Authors make mention of two sorts of this oil, one expressed from the olives when fully ripe, which is our common oil olive; the other, before it has grown ripe; this is called *oleum immaturum*, and *omphacium*. Nothing is met with in the shops under this name; and Lemery affirms, that there is no such oil, unripe olives yielding only a viscid juice to the press. From the ripe fruit, two or three sorts are obtained, differing in degree of purity; the purest runs by light pressure; the remaining magma, heated and pressed more strongly, yields an inferior sort, with some dregs at the bottom, called *amura*. All these oils contain a considerable portion of aqueous moisture, and a mucilaginous substance; which subject them to run into a putrid state; to prevent this, the preparers add some sea salt, which imbibing the aqueous and mucilaginous parts, sinks with them to the bottom; by this means the oil becomes more homogeneous, and consequently less susceptible of alteration. In its passage to us, some of the salt, thrown up from the bottom by the shaking of the vessel, is sometimes mixed with and detained in the oil, which, in our colder climate, becomes too thick to suffer it freely to subside; and hence the oil is sometimes met with of a manifestly saline taste. Oil-olive is used in the simple balsam of sulphur, Locatellie's balsam, and several ointments. It is oftner employed in this last intention than the other expressed oils, but more rarely for internal medicinal purposes.
- OLEAGINOUS**, something that partakes of the nature of oil, or out of which oil may be expressed.
- OLECRANUM**, or **OLECRANON**, in anatomy. See **ANATOMY**, p. 178.
- OLERON**, an island of France, near the coast of Poictou, fourteen miles south-west of Rochelle, being about fifteen miles long, and six broad.
- Sea-laws of OLERON*, certain laws relating to maritime affairs, made in the time of Rich. I. when he was at the island Oleron.
- These laws, being accounted the most excellent sea-laws in the world, are recorded in the black book of the admiralty.
- OLESCO**, a town of upper Volhinia, in Poland: east longitude 24°, and north latitude 50°.
- OLFACTORY NERVES**. See **ANATOMY**, p. 248.
- OLIBANUM**, **FRANK-INCENSE**, in pharmacy, a dry resinous substance, brought to us in detached pieces, or drops as it were, like those of mastic; but larger, and of a less pure and pellucid texture.
- It is of a pale yellowish white colour, but with some mixture of a brownish cast in it. It is moderately heavy; its smell is strong, but not disagreeable; and its taste bitter, acrid, and resinous.
- Olibanum is to be chosen whitish, pure, dry, and as much approaching to pellucidity as may be.
- Olibanum is greatly commended by many against disorders of the head and breast, and against diarrhœas and

and dysenteries, and profluvia of the menses, and the fluor albus. Its dose is from ten grains to a drachm. It is esteemed by many a specific in pleurifies, especially when epidemic.

Externally it is used in fumigations for disorders of the head, and against catarrhs; and is an ingredient in some plasters. It is a noble balsam in consumptions, given in substance, or dissolved with the yolk of an egg into the form of an emulsion. There is an oil made of it per deliquium, in the same manner as that of myrrh: this is done by putting the powder of it in the white of a boiled egg, in a cellar, till it runs into a liquor; this is esteemed a great cosmetic, and destroyer of pimples in the face.

**OLIGAEDRA**, in natural history, the name of a genus of crystals, and expresses that which is composed of only a few planes.

The bodies of this class are crystals of the imperfect kind, being composed of columns affixed irregularly to some solid body at one end, and the other terminated by a pyramid; but the column and pyramid being both pentangular, the whole consists only of ten planes, and not, as the common kind, of twelve.

**OLIGARCHY**, a form of government, wherein the administration of affairs is lodged in the hands of a few persons.

**OLINDA**, a city and port-town of Brasil: west long. 35°, and south lat. 8°.

**OLIO**, in cookery, denotes a favourable dish composed of a great variety of ingredients, chiefly used by the Spaniards.

**OLIVA**, a port-town of Poland, in the province of regal Prussia, only six miles west of Dantzick.

**OLIVARIA CORPORA**, in anatomy. See **ANATOMY**, p. 287.

**OLIVE**, in botany. See **OLEA**.

**OLIVE-COLOUR**, a yellow mingled with black. See **OPTICS**.

**OLIVENZA**, a town of Alentejo, in Portugal, ten miles south of Elvas.

**OLMUTS**, a city of Moravia, seventy-five miles north of Vienna.

**OLYMPIA**, a port-town of the Morea, at present called Longinico: east long. 21° 35', and north lat. 37° 40'.

**OLYMPIAD**, the space or period of four years, whereby the Greeks reckoned time. See **ASTRONOMY**, p. 493.

**OLYMPIC GAMES** were solemn games, famous among the ancient Greeks, so called from Olympian Jupiter, to whom they were dedicated; and by some said to be first instituted by Jupiter, after his victory over the sons of Titan; others ascribe their institution to Hercules, not the son of Alcmena, but one of much greater antiquity; others, to Pelops; and others, to Hercules the son of Alcmena. These games were so considerable, that the Greeks made them their epocha, distinguishing their years by the return of the olympics.

The care and management of these games belonged, for the most part, to the Eleans, who, on that account, enjoyed their possessions without molestation, or fear of

war or violence. They appointed a certain number of judges, who were to take care that those who offered themselves as competitors performed their preparatory exercises; and these judges, during the solemnity, sat naked, having before them a crown of victory, formed of wild-olive, which was presented to whomsoever they adjudged it. Those who were conquerors, were called Olympionics, and were loaded with honours by their countrymen. At these games women were not allowed to be present; and if any woman was found to have passed the river Alpheus, during the solemnity, she was to be thrown headlong from a rock.

**OLYMPUS**, the name of two mountains, the one in Bythinia in the Lesser Asia, and the other in the island of Cyprus.

**OMAN**, a province or kingdom in the south-east parts of Arabia Felix.

**OMBRE**, a celebrated game at cards, borrowed from the Spaniards, and played by two, by three, or by five persons, but generally by three.

**OMBRE DE SOLEIL**, **SHADOW OF THE SUN**, in heraldry, is when the sun is borne in armor, so as that the eyes, nose, and mouth, which at other times are represented, do not appear; and the colouring is thin, so that the field can appear through it.

**OMBRIA**, the ancient name of a province of Italy, in the territory of the pope, now called Spoleto and Perugia.

**OMBRO**, or **LOMBRO**, a town of Italy, in the duchy of Tuscany, and territory of the Siennois, situated near the Tuscan sea, a little south of the lake of Castiglion, forty-five miles south-west of Sienna.

**OMELET**, or **AMLET**, a kind of pancake or fricasse of eggs, with other ingredients, very usual in Spain and France.

**OMEN**, a certain accident and casual occurrence that was thought to presage either good or evil. There were three sorts of omens among the ancients. One was of things internal, or those which affected the persons themselves; the second, of things external, that only appeared to men, but did not make any impression on them; the third were ominous words. Of the first sort were those sudden conternations, called panic fears, that seized upon men without any visible cause, and were therefore imputed to the dæmons, especially the god Pan: of these panics there is frequent mention in history. The second sort of omens were of such things as appeared to men, but were not contained in their own bodies. Of these there were several sorts: the beginning of things were thought to contain something ominous: it was thought a direful omen, when any thing unusual befel the temples, altars, or statues of the gods. Under the head of external omens are to be placed those which offered themselves in the way; such were the meeting of an eunuch, a black, a bitch with whelps, a snake lying in the road, &c. Words were ominous; and as they were good or bad, were believed to presage accordingly.

**OMENTUM**, in anatomy. See **ANATOMY**, p. 266.

**OMERS**,

- OMERS, or St. OMERS, a city of Artois, in the French Netherlands, twenty miles south of Dunkirk, and eighteen south-east of Calais.
- OMLANDS, a division of the province of Groningen, in the United Provinces.
- OMMEN, a town of the United Netherlands, in the province of Overijssel, situated on the lesser Vecht, seventeen miles north-east of Deventer.
- OMOPHAGIA, an ancient Greek festival, in honour of Bacchus, surnamed Omophagos, *i. e.* eater of raw flesh. This festival was observed in the same manner with the other festivals of Bacchus, in which they counterfeited madness; what was peculiar to it, was that the worshippers used to eat the entrails of goats, raw and bloody, in imitation of the god, who was supposed to do the same thing.
- OMOPLATE, in anatomy. See ANATOMY, p. 176.
- OMPHALO-MESENERIC, in anatomy. All testicles are wrapped up in at least two coats or membranes; most of them have a third, called allantoides, or urinary.
- Some, as the dog, cat, hare, &c. have a fourth, which has two blood-vessels, *viz.* a vein and an artery, called omphalo-mesenterics, because passing along the string to the navel, and terminating in the mesentery.
- ONANDAGOES, one of the tribes of the Iroquois, or Five Nations, situated on the lake Ontario, or Frontenac, in North America: they are allies of Great Britain.
- ONANIA, or ONANISM, terms which some late empirics have framed, to denote the crime of self-pollution, mentioned in scripture to have been practised by Onan, and punished in him with death.
- ONEGA-LAKE, a lake upwards of an hundred miles long, and forty broad, situated in the empire of Russia between 61° and 63° of north lat. and 35° east longitude.
- ONEGLIA, a port town of Italy, seventy miles south-west of Genoa, subject to the king of Sardinia: E. long. 8° 30', and north lat. 44°.
- ONEIROCRITICA, the art of interpreting dreams, or predicting future events from dreams.
- ONGAR, a market town of Essex, ten miles west of Chelmsford.
- ONGLE'E, in heraldry, an appellation given to the talons or claws of beasts or birds, when borne of a different colour from that of the body of the animal.
- ONION. See CÉPA.
- ONISCUS, in zoology, a genus of insects, belonging to the order of aptera. It has 14 feet, bristly feelers, and an oval body. There are 17 species.
- ONKOTOMY, in surgery, the operation of opening a tumour or abscess. See SURGERY.
- ONOCLEA, in botany, a genus of the cryptogamia filices class: the fruit consists of several globular capsules, with five valves and one cell, in which are several small hairy seeds.
- ONOCROTALUS, in ornithology. See PELICANUS.
- ONOMANCY, a branch of divination, which foretels

the good or bad fortune of a man, from the letters in his name.

From much the same principle the young Romans toasted their mistresses as often as there were letters in their names: hence Martial says,

*Nevia sex cyathis, septem Justina bibatur.*

ONOMATOPOEIA, in grammar and rhetoric, a figure where words are formed to resemble the sound made by the things signified; as the buzz of bees, the cackling of hens, &c.

ONONIS, in botany, a genus of the diadelphia decandria class. The calix has five segments; the vexillum is striated; and the pod is sessile and turgid. There are 19 species, three of them natives of Britain, *viz.* the spinosa, or rest-harrow; the arvensis, or corn rest-harrow; and the repens, or creeping rest-harrow.

ONOPORDUM, a genus of the syngenesia polygamia æqualis class. The receptacle is naked, and the scales of their calix are sharp-pointed. There are four species, none of them natives of Britain.

ONTARIO, or FRONTENAC, a lake of North America: situated in W. long. 79°, and between 41° and 43° N. lat.

ONTOLOGY. See METAPHYSICS.

ONYX, in natural history, one of the semipellucid gems, with variously coloured zones, but none red; being composed of crystal, debased by a small admixture of earth; and made up either of a number of flat plates, or of a series of coats surrounding a central nucleus, and separated from each other by veins of a different colour, resembling zones or belts.

We have four species of this gem. 1. A bluish white one, with broad white zones. 2. A very pure onyx, with snow-white veins. 3. The jasponyx, or horny onyx, with green zones. 4. The brown onyx, with bluish white zones.

OOST, a kiln for drying hops after they are picked from the stalks.

OOSTERGO, the north division of West Friesland, one of the United Provinces.

OPACITY, in philosophy, a quality of bodies which renders them impervious to the rays of light. See OPTICS.

OPAL, in natural history, a species of gems.

The opal is a gem of a peculiar kind, and has been esteemed by many in all ages of very great value; though at present it is of less value, in proportion to its size, than any of the finer gems. It is softer than any other of the fine gems, and is difficult to polish to any degree of nicety. It is found of various shapes and sizes: its most frequent bigness is between that of a pea and a horse-bean; but it is found as small as the head of a large pin, and has been seen of the size of a large walnut. Its figure is very various and uncertain, but it is never found in a crystalliform or columnar state; its most usual shape is an irregularly oblong one, convex above, flattened at bottom, and dented with various sinuosities at its sides. It is often found among the loose earth of mountains, sometimes on the shores of rivers, and not unfrequently bedded in the coarser kinds of jasper.

It is found in Egypt, Arabia, some parts of the East-Indies, and in many parts of Europe: those of Europe are principally from Bohemia, and are of a greenish or greyish colour; the colour of other opals much resembles the finest mother of pearl, its basis seeming a bluish or greyish white, but with a property of reflecting all the colours of the rainbow, as turned differently to the light.

**OPALIA**, in antiquity, feasts celebrated at Rome in honour of the goddess Ops. Varro says they were held on the nineteenth of December, which was one of the days of the Saturnalia: these two feasts were celebrated in the same month, because Saturn and Ops were husband and wife: the vows offered to the goddess were made sitting on the ground.

**OPERA**, a dramatic composition set to music, and sung on the stage, accompanied with musical instruments, and enriched with magnificent dresses, machines, and other decorations.

**OPERATION**, in general, the act of exerting or exercising some power or faculty, upon which an effect follows.

**OPERATION**, in chirurgery, denotes a methodical action of the hand on the human body, in order to reestablish health. See **SURGERY**.

**OPERATOR**, a person who performs an operation.

**OPHIDIUM**, in ichthyology, a genus belonging to the order of apodes. The head is somewhat naked; the teeth are in the jaws, palate, and fauces; there are seven rays in the gill membrane; and the body is shaped like a sword. There are two species, *viz.* the barbatus, with four cirri; and the imberbe, which has no cirri, and the tail is blunt.

**OPHIOGLOSSUM**, in botany, a genus of the cryptogamia filices class. The spike is jointed. There are seven species, only one of which, *viz.* the vulgatum, or adders-tongue, is a native of Britain.

**OPHIOMANCY**, in antiquity, the art of making predictions from serpents. Thus Calchas, on seeing a serpent devour eight sparrows with their dam, foretold the duration of the siege of Troy. And the seven coils of a serpent that was seen on Anchises's tomb, were interpreted to mean the seven years that Æneas wandered from place to place before he arrived in Latium.

**OPHIORHIZA**, in botany, a genus of the pentandria monogynia class. The calix is funnel shaped; the germen is bifid; it has two stigmata; and the fruit has two lobes; there are two species, none of them natives of Britain.

**OPHIOXYLON**, in botany, a genus of the polygamia monoecia class. The corolla and calix of the hermaphrodite consists of five segments; it has five stamina, and one pistillum: The calix of the male is bifid; the corolla is funnel-shaped, with a cylindrical nectarium near the inner edge, and consists of five segments; it has only two stamina. There is but one species, a native of Ceylon.

**OPHITES**, in natural history, a sort of variegated marble, of a dusky green ground, sprinkled with spots of a lighter green, otherwise called serpentine.

**OPHITES**, in church history, Christian heretics, so called both from the veneration they had for the serpent that tempted Eve, and the worship they paid to a real serpent.

**OPHYRS**, in botany, a genus of the gynandria diandria class. The nectarium has a kind of carina on the under part. There are 18 species, eleven of which are natives of Britain.

**OPHTHALMIA**, in medicine, an inflammation of the membranes which invest the eye; especially of the adnata, or albugineous coat. See **MEDICINE**.

**OPHTHALMIC NERVES**. See **ANATOMY**, p. 248.

**OPHTHALMOSCOPY**, a branch of physiognomy, which deduces the knowledge of a man's temper and manners from the appearance of his eyes.

**OPIATES**, medicines of a thicker consistence than a syrup, prepared with opium scarcely fluid. They consist of various ingredients, made up with honey or syrup; and are to be used for a long time either for purgative, alterative, or corroborative intentions.

The word opiate is also used, in general, for any medicine given with an intention to procure sleep, whether in the form of electuaries, drops, or pills.

**OPINION**, is defined to be an assent of the mind to propositions not evidently true at first sight.

**OPISTHOTONOS**, in medicine, a kind of convulsion, wherein the body is bent backwards.

**OPIUM**, in the materia medica, is an inspissated juice, partly of the resinous, and partly of the gummy kind, brought to us in cakes from eight ounces to a pound weight. It is very heavy, of a dense texture, and not perfectly dry; but, in general, easily receives an impression from the finger: its colour is a brownish yellow, so very dark and dusky that at first it appears black: it has a dead and faint smell, and its taste is very bitter and acrid. It is to be chosen moderately firm, and not too soft; its smell and taste should be very strong, and care is to be taken that there is no dirty or stony matter in it.

Opium is the juice of the papaver album, or white poppy, with which the fields of Asia Minor are in many places sown, as ours are with corn. When the heads are near ripening, they wound them with an instrument that has five edges, which on being stuck into the head makes at once five long cuts in it; and from these wounds the opium flows, and is next day taken off by a person who goes round the field, and put up in a vessel which he carries fastened to his girdle; at the same time that this opium is collected, the opposite side of the poppy head is wounded, and the opium collected from it the next day. They distinguish, however, the produce of the first wounds from that of the succeeding ones; for the first juice afforded by the plant is greatly superior to what is obtained afterwards. After they have collected the opium, they moisten it with a small quantity of water or honey, and work it a long time upon a flat, hard, and smooth board, with a thick and strong instrument of the same wood, till it becomes of the consistence of pitch; and then work it up with their hands, and form it into cakes or rolls for sale.

Opium at present is in great esteem, and is one of the most valuable of all the simple medicines. Applied externally, it is emollient, relaxing, and discutient, and greatly promotes suppuration: if long kept, upon the skin, it takes off the hair, and always occasions an itching in it; sometimes it exulcerates it, and raises little blisters, if applied to a tender part: sometimes, on external application, it allays pain, and even occasions sleep: but it must by no means be applied to the head, especially to the sutures of the skull; for it has been known to have the most terrible effects in this application, and even to bring on death itself. Opium, taken internally removes melancholy, eases pain, and disposes to sleep; in many cases removes hæmorrhages, provokes sweating. A moderate dose is commonly under a grain; though, according to the circumstances, two grains, or even three, may be within the limits of this denomination: but custom will make people bear a dram or more; though in this case nature is vitiated, and nothing is to be hence judged in regard to others. If given dissolved, it operates in half an hour; if in a solid form, as in pills, or the like, it is sometimes an hour and a half. Its first effect, in this case, is the making the patient cheerful, as if he had drank moderately of wine, and at the same time bold and above the fear of danger; for which reason the Turks always take it when they are going to battle. A very immoderate dose brings on a sort of drunkenness, much like that occasioned by an immoderate quantity of strong liquors; cheerfulness and loud laughter at first, than a relaxation of the limbs, a loss of memory, and lightheadedness; then vertiges, dimness of the eyes, with a laxity of the cornea and a dilatation of the pupils, a slowness of the pulse, redness of the face, relaxation of the under jaws, swelling of the lips, difficulty of breathing, painful erection of the penis, convulsions, cold sweats, and finally death. Those who escape are usually relieved by a great number of stools, or profuse sweats.

Prepared opium, commonly called extract of opium, is made by dissolving opium in a sufficient quantity of water with a gentle heat; then straining the solution from the fæces, and evaporating it to the consistence

of honey. Tincture of opium, or liquid laudanum, otherwise called the thebaic tincture, is made as follows: Take of prepared opium, two ounces; of cinnamon and cloves, each one drachm; of white-wine, one pint; infuse them a week without heat, and then filter it through paper.

OPOEALSAMUM, in the materia medica. See BALSAM.

OPOPANAX, in the materia medica, is a gum resin of a tolerably firm texture, usually brought to us in loose granules or drops, and sometimes in large masses, formed of a number of these connected by a quantity of matter of the same kind; but these are usually loaded with extraneous matter, and are greatly inferior to the pure loose kind. The drops or granules of the fine opopanax; are on the outside of a brownish red colour, and of a dusky yellowish or whitish colour within: they are of a somewhat unctuous appearance, smooth on the surface; and are to be chosen in clear pieces, of a strong smell and acrid taste.

Opopanax is attenuating and discutient, and is gently purgative; it dispels flatulencies, and is good in asthma, in inveterate coughs, and in disorders of the hand and nerves. It also promotes the menses, and is good against all obstructions of the viscera.

OPOSSUM, in zoology. See DIDELPHIS.

OPPILATION, in medicine, the act of obstructing or stopping up the passages of the body; by redundant or peccant humours. This word is chiefly used for obstructions in the lower belly.

OPPONENT, a person who withstands or opposes another.

OPPOSITION, in logic, the disagreement between propositions which have the same subject and the same predicate.

OPTATIVE MOOD, in grammar, that which serves to express an ardent desire or wish for something.

In most languages, except the Greek, the optative is only expressed by prefixing to the subjunctive an adverb of wishing; as *utinam*, in Latin; *plut a Dieu*, in French; and *would to God*, in English.

OPTERIA, in antiquity, presents made by a bridegroom to his bride, when first conducted to him.

## O P T I C S.

THE cause and nature of vision are properly the subject of that part of natural philosophy which is called Optics: but as light is the cause of vision, the word Optics is commonly used in a more extensive sense; and every thing is looked upon as a part of Optics which relates to the nature and qualities of light. If we use the word Optics, in the stricter sense of it, for the theory of vision, the science of Optics is divided into two parts, *viz.* Dioptrics and Catoptrics. The laws of refraction, and the effects which the refraction of light has in vision, are the subject of Dioptrics: The laws of reflection, and the effects which the reflection of light has in vision, are the

subject of Catoptrics. But this division of Optics is of no use; for there are many propositions in Optics where both parts are mixed, and many that cannot be properly reduced to either; and therefore we shall not make any use of that distinction in the following Treatise.

### Of LIGHT.

LIGHT consists of an inconceivably great number of particles flowing from a luminous body in all manner of directions; and these particles are so small, as to surpass all human comprehension.

That the number of particles of light is inconceivably great

great, appears from the light of a candle; which, if there be no obstacle in the way to obstruct the passages of its rays, will fill all the space within two miles of the candle every way with luminous particles, before it has lost the least sensible part of its substance.

A ray of light is a continued stream of these particles, flowing from any visible body in a straight line: and that the particles themselves are incomprehensibly small, is manifest from the following experiment. Make a small pin-hole in a piece of black paper, and hold the paper upright on a table facing a row of candles standing by one another; then place a sheet of pasteboard at a little distance behind the paper, and some of the rays which flow from all the candles through the hole in the paper, will form as many specks of light on the pasteboard, as there are candles on the table before the plate: each speck being as distinct and clear, as if there was only one speck from one single candle: which shews, that the particles of light are exceedingly small, otherwise they could not pass through the hole from so many different candles without confusion — Dr Niewentyt has computed, that there flows more than 6,000,000,000,000 times as many particles of light from a candle in one second of time, as there are grains of sand in the whole earth, supposing each cubic inch of it to contain 1,000,000.

These particles, by falling directly upon our eyes, excite in our minds the idea of light. And when they fall upon bodies, and are thereby reflected to our eyes, they excite in us the ideas of these bodies. And as every point of a visible body reflects the rays of light in all manner of directions, every point will be visible in every part to which the light is reflected from it. Thus the object *ABC* (OPTICAL PLATES, fig. n<sup>o</sup> 1.) is visible to an eye in any part where the rays *Aa*, *Ab*, *Ac*, *Ad*, *Ae*, *Ba*, *Bb*, *Bc*, *Bd*, *Be*, and *Ca*, *Cb*, *Cc*, *Cd*, *Ce*, come. Here we have shewn the rays as if they were only reflected from the ends *A* and *B*, and from the middle point *C* of the object; every other point being supposed to reflect rays in the same manner. So that, where-ever a spectator is placed with regard to the body, every point of that part of the surface which is towards him will be visible, when no intervening object stops the passage of the light.

Since no object can be seen through the bore of a bended pipe, it is evident that the rays of light move in straight lines, whilst there is nothing to refract or turn them out of their rectilineal course.

Whilst the rays of light continue in any \* medium of an uniform density, they are straight; but when they pass obliquely out of one medium into another which is either more dense or more rare, they are refracted towards the denser medium: and this refraction is more or less, as the rays fall more or less obliquely on the refracting surface which divides the mediums.

To prove this by experiment, set the empty vessel *ABCD* (No. 2.) into any place where the sun shines obliquely, and observe the part where the shadow of the edge *BC* falls on the bottom of the vessel at *E*; then fill the vessel with water, and the shadow will reach no farther than *e*; which shews, that the ray *aBE*, which came

straight in the open air, just over the edge of the vessel at *B* to its bottom at *E*, is refracted by falling obliquely on the surface of the water at *B*; and instead of going on in the rectilineal direction *aBE*, it is bent downward in the water from *B* to *e*, the whole bend being at the surface of the water: and so of all other rays *abc*.

If a stick be laid over the vessel, and the sun's rays be reflected from a glass perpendicularly into the vessel, the shadow of the stick will fall upon the same part of the bottom, whether the vessel be empty or full; which shews that the rays of light are not refracted when they fall perpendicularly on the surface of any medium.

The rays of light are as much refracted by passing out of water into air, as by passing out of air into water. Thus, if a ray of light flows from the point *e*, under water, in the direction *eB*; when it comes to the surface of the water at *B*, it will not go on thence in the rectilineal course *Bd*, but will be refracted into the line *Ba*. Therefore,

To an eye at *e* looking through a plane glass in the bottom of the empty vessel, the point *a* cannot be seen, because the side *Bc* of the vessel interposes; and the point *d* will just be seen over the edge of the vessel at *B*. But if the vessel be filled with water, the point *a* will be seen from *e*; and will appear as at *d*, elevated in the direction of the ray *eB*. Hence a piece of money lying at *e*, in the bottom of an empty vessel, cannot be seen by an eye at *a*, because the edge of the vessel intervenes; but let the vessel be filled with water, and the ray *ea* being then refracted at *B*, will strike the eye at *a*, and so render the money visible, which will appear as if it were raised up to *f* in the line *aBf*.

The time of sun-rising or setting, supposing its rays suffered no refraction, is easily found by calculation. But observation proves, that the sun rises sooner and sets later every day than the calculated time; and the reason of which is plain, from what was said immediately above. For, though the sun's rays do not come part of the way to us through water, yet they do through the air or atmosphere, which being a grosser medium than the free space between the sun and the top of the atmosphere, the rays, by entering obliquely into the atmosphere, are there refracted, and thence bent down to the earth. And although there are many places of the earth to which the sun is vertical at noon, and consequently his rays can suffer no refraction at that time, because they come perpendicularly through the atmosphere; yet there is no place to which the sun's rays do not fall obliquely on the top of the atmosphere, at his rising and setting; and consequently, no clear day in which the sun will not be visible before he rises in the horizon, and after he sets in it; and the longer or shorter, as the atmosphere is more or less replete with vapours. For, let *ABC*, (No. 3.) be part of the earth's surface, *DEF* the atmosphere that covers it, and *EBGH* the sensible horizon of an observer at *B*. As every point of the sun's surface sends out rays of light in all manner of directions, some of his rays will constantly fall upon, and enlighten, some half of our atmosphere; and

\* Anything through which the rays of light can pass, is called a medium; as air, water, glass, diamond, or even a vacuum.

and therefore, when the sun is at  $I$ , below the horizon  $H$ , those rays which go on in the free space  $IkK$  preserve a rectilinear course until they fall upon the top of the atmosphere; and those which fall so about  $K$ , are refracted at their entrance into the atmosphere, and bent down in the line  $KmB$ , to the observer's place at  $B$ : and therefore, to him the sun will appear at  $L$ , in the direction of the ray  $BmK$ , above the horizon  $BGH$ , when he is really below it at  $I$ .

The angle contained between a ray of light, and a perpendicular to the refracting surface, is called *the angle of incidence*; and the angle contained between the same perpendicular, and the same ray after refraction, is called *the angle of refraction*. Thus (No. 4.) let  $LBM$  be the refracting surface of a medium (suppose water,) and  $ABC$  a perpendicular to that surface; let  $DB$  be a ray of light, going out of air into water at  $B$ , and therein refracted in the line  $BH$ ; the angle  $ABD$ , is the angle of incidence, of which  $DF$  is the sine; and the angle  $KBH$  is the angle of refraction, whose sine is  $KI$ .

When the refracting medium is water, the sine of the angle of incidence is to the sine of the angle of refraction as 4 to 3; which is confirmed by the following experiment, taken from Doctor SMITH'S Optics.

Describe the circle  $DAEC$  on a plane square board, and cross it at right angles with the straight lines  $ABC$ , and  $LBM$ ; then, from the intersection  $A$ , with any opening of the compasses, set off the equal arcs  $AD$  and  $AE$ , and draw the right line  $DFE$ : then, taking  $Fa$ , which is three quarters of the length  $FE$ , from the point  $a$ , draw  $aI$  parallel to  $ABK$ , and join  $KI$  parallel to  $BM$ : so  $KI$  will be equal to three quarters of  $FE$  or of  $DF$ . This done, fix the board upright upon the leaden pedestal  $O$ , and stick three pins perpendicularly into the board, at the points  $D$ ,  $B$ , and  $I$ : then set the board upright into the vessel  $TUV$ , and fill up the vessel with water to the line  $LBM$ . When the water has settled, look along the line  $DB$ , so as you may see the head of the pin  $B$  over the head of the pin  $D$ ; and the pin  $I$  will appear in the same right line produced to  $G$ , for its head will be seen just over the head of the pin at  $B$ : which shews that the ray  $IB$ , coming from the pin at  $I$ , is so refracted at  $B$ , as to proceed from thence in the line  $BD$  to the eye of the observer; the same as it would do from any point  $G$  in the right line  $DBG$ , if there were no water in the vessel: and also shews, that  $KI$ , the sine of refraction in water, is to  $DF$ , the sine of incidence in air, as 3 to 4.

Hence, if  $DBH$  were a crooked stick put obliquely into the water, it would appear a straight one at  $DBG$ . Therefore, as the line  $BH$  appears at  $BG$ , so the line  $BG$  will appear at  $Bg$ ; and consequently, a straight stick  $DBG$  put obliquely into water, will seem bent at the surface of the water in  $B$ , and crooked, as  $DBg$ .

When a ray of light passes out of air into glass, the sine of incidence is to the sine of refraction as 3 to 2; and when out of air into a diamond, as 5 to 2.

#### Of GLASSES.

GLASS may be ground into eight different shapes at least, for optical purposes, *viz.*

1. A *plane glass*, (No. 5.) which is flat on both sides, and of equal thickness in all parts, as  $A$ .
2. A *plano-convex*, which is flat on one side, and convex on the other, as  $B$ .
3. A *double-convex*, which is convex on both sides, as  $C$ .
4. A *plano-concave*, which is flat on one side, and concave on the other, as  $D$ .
5. A *double concave*, which is concave on both sides, as  $E$ .
6. A *meniscus*, which is concave on one side, and convex on the other, as  $F$ .
7. A *flat plano-convex*, whose convex side is ground into several little flat surfaces, as  $G$ .
8. A *prism*, which has three flat sides; and when viewed endwise, appears like an equilateral triangle, as  $H$ .

Glasses ground into any of the shapes  $B$ ,  $C$ ,  $D$ ,  $E$ ,  $F$ , are generally called *lenses*.

A right line  $LHK$ , (No. 6.) going perpendicularly through the middle of a lens, is called *the axis of the lens*.

A ray of light  $Gh$ , falling perpendicularly on a plane glass  $EF$ , will pass through the glass in the same direction  $hi$ , and go out of it into the air in the same right course  $iH$ .

A ray of light  $AB$ , falling obliquely on a plane glass, will go out of the glass in the same direction, but not in the same right line: for in touching the glass, it will be refracted in the line  $BC$ ; and in leaving the glass, it will be refracted in the line  $CD$ .

A ray of light  $CD$ , (No. 7.) falling obliquely on the middle of a convex glass, will go forward in the same direction  $DE$ , as if it had fallen with the same degree of obliquity on a plane glass; and will go out of the glass in the same direction with which it entered: for it will be equally refracted at the points  $D$  and  $E$ , as if it had passed through a plane surface. But the rays  $CG$  and  $CI$  will be so refracted, as to meet again at the point  $F$ . Therefore, all the rays which flow from the point  $G$ , so as to go through the glass, will meet again at  $F$ ; and if they go farther onward, as to  $L$ , they cross at  $F$ , and go forward on the opposite sides of the middle ray  $CDEF$ , to what they were in approaching it in the directions  $HF$  and  $KF$ .

When parallel rays, as  $ABC$ , (No. 8.) fall directly upon a plano-convex glass  $DE$ , and pass through it, they will be so refracted, as to unite in a point  $f$  behind it; and this point is called the *principal focus*; the distance of which, from the middle of the glass, is called the *focal distance*, which is equal to twice the radius of the sphere of the glass's convexity. And,

When parallel rays, as  $ABC$ , (No. 9.) fall directly upon a glass  $DE$ , which is equally convex on both sides, and pass through it; they will be so refracted, as to meet in a point or principal focus  $f$ , whose distance is equal to the radius or semidiameter of the sphere of the glass's convexity. But if a glass be more convex on one side than on the other, the rule for finding the focal distance is this: As the sum of the semidiameters of both convexities is to the semidiameter of either, so is double the semidiameter

semidiameter of the other to the distance of the focus. Or, divide the double product of the radii by their sum, and the quotient will be the distance sought.

Since all those rays of the sun which pass through a convex glass are collected together in its focus, the force of all their heat is collected into that part; and is in proportion to the common heat of the sun, as the area of the glass to the area of the focus. Hence we see the reason why a convex glass causes the sun's rays to burn after passing through it.

All these rays cross the middle ray in the focus  $f$ , and then diverge from it, to the contrary sides, in the same manner  $FfG$ , as they converged in the space  $DfE$  in coming to it.

If another glass  $FG$ , of the same convexity as  $DE$ , be placed in the rays at the same distance from the focus, it will refract them so, as that, after going out of it, they will be all parallel, as  $abc$ ; and go on in the same manner as they came to the first glass  $DE$ , through the space  $ABC$ ; but on the contrary sides of the middle ray  $Bfb$ : for the ray  $ADf$  will go on from  $f$  in the direction  $fGa$ , and the ray  $CEf$  in the direction  $fFc$ ; and so of the rest.

The rays diverge from any radiant point, as from a principal focus: therefore if a candle be placed at  $f$ , in the focus of the convex glass  $FG$ , the diverging rays in the space  $Efg$  will be so refracted by the glass, as that, after going out of it, they will become parallel, as shewn in the space  $cba$ .

If the candle be placed nearer the glass than its focal distance, the rays will converge after passing through the glass more or less as the candle is more or less distant from the focus.

If the candle be placed farther from the glass than its focal distance, the rays will converge after passing through the glass, and meet in a point, which will be more or less distant from the glass as the candle is nearer to or farther from its focus: and where the rays meet, they will form an inverted image of the flame of the candle; which may be seen on a paper placed in the meeting of the rays.

Hence, if any object  $ABC$  (No. 10.) be placed beyond the focus  $F$  of the convex glass  $def$ , some of the rays which flow from every point of the object, on the side next the glass, will fall upon it; and after passing through it, they will be converged into as many points on the opposite side of the glass, where the image of every point will be formed, and consequently the image of the whole object, which will be inverted. Thus, the rays  $Ad$ ,  $Ae$ ,  $Af$ , flowing from the point  $A$ , will converge in the space  $daf$ , and by meeting at  $a$  will there form the image of the point  $A$ . The rays  $Bb$ ,  $Be$ ,  $Bf$ , flowing from the point  $B$ , will be united at  $b$  by the refraction of the glass, and will there form the image of the point  $B$ . And the rays  $Cd$ ,  $Ce$ ,  $Cf$ , flowing from the point  $C$ , will be united at  $c$ , where they will form the image of the point  $C$ . And so of all the other intermediate points between  $A$  and  $C$ . The rays which flow from every particular point of the object, and are united again by the glass, are called *pencils of rays*.

If the object  $ABC$  be brought nearer to the glass, the picture  $abc$  will be removed to a greater distance. For then more rays flowing from every single point, will all

more diverging upon the glass; and therefore cannot be so soon collected into the corresponding points behind it. Consequently, if the distance of the object  $ABC$  (No. 11.) be equal to the distance  $eB$  of the focus of the glass, the rays of each pencil will be so refracted by passing through the glass, that they will go out of it parallel to each other; as  $dI$ ,  $eH$ ,  $fh$ , from the point  $C$ ;  $dG$ ,  $eK$ ,  $fD$ , from the point  $B$ ; and  $dK$ ,  $eE$ ,  $fL$ , from the point  $A$ : and therefore, there will be no picture formed behind the glass.

If the focal distance of the glass, and the distance of the object from the glass, be known, the distance of the picture from the glass may be found by this rule, *viz.* Multiply the distance of the focus by the distance of the object, and divide the product by the difference; the quotient will be the distance of the picture.

The picture will be as much bigger or less than the object, as its distance from the glass is greater or less than the distance of the object. For, as  $Be$  (No. 10.) is to  $eB$ , so is  $AG$  to  $ca$ . So that if  $ABC$  be the object,  $cba$  will be the picture; or if  $cba$  be the object,  $ABC$  will be the picture.

Having described how the rays of light, flowing from objects and passing through convex glasses, are collected into points, and form the images of the objects; it will be easy to understand how the rays are affected by passing through the humours of the eye, and are thereby collected into innumerable points on the bottom of the eye, and thereon form the images of the objects which they flow from. For, the different humours of the eye, and particularly the chrySTALLINE humour, are to be considered as a convex glass; and the rays in passing through them to be affected in the same manner as in passing through a convex glass.—For a description of the coats and tumours of the eye, see ANATOMY, p. 289.

As every point of an object  $ABC$ , (No. 12.) sends out rays in all directions, some rays, from every point on the side next the eye, will fall upon the cornea between  $E$  and  $F$ ; and by passing on through the humours and pupil of the eye, they will be converged to as many points on the retina or bottom of the eye, and will thereon form a distinct inverted picture  $cba$  of the object. Thus, the pencil of rays  $grg$  that flows from the point  $A$  of the object, will be converged to the point  $a$  on the retina; those from the point  $B$  will be converged to the point  $b$ ; those from the point  $C$  will be converged to the point  $c$ ; and so of all the intermediate points; by which means the whole image  $abc$  is formed, and the object made visible: although it must be owned, that the method by which this sensation is carried from the eye by the optic nerve to the common sensory in the brain, and there discerned, is above the reach of our comprehension.

But that vision is effected in this manner, may be demonstrated experimentally. Take a bullock's eye whilst it is fresh, and having cut off the three coats from the back part, quite to the vitreous humour, put a piece of white paper over that part, and hold the eye towards any bright object, and you will see an inverted picture of the object upon the paper.

Since the image is inverted, many have wondered why the object appears upright. But we are to consider, 1. That *inverted* is only a relative term; and, 2. That

there is a very great difference between the real object and the means or image by which we perceive it. When all the parts of a distant prospect are painted upon the retina, they are all right with respect to one another, as well as the parts of the prospect itself; and we can only judge of an object's being inverted, when it is turned reverse to its natural position with respect to other objects which we see and compare it with.—If we lay hold of an upright stick in the dark, we can tell which is the upper or lower part of it, by moving our hand downward or upward; and know very well that we cannot feel the upper end by moving our hand downward. Just so we find by experience, that upon directing our eyes towards a tall object, we cannot see its top by turning our eyes downward, nor its foot by turning our eyes upward; but must trace the object the same way by the eye to see it from head to foot, as we do by the hand to feel it; and as the judgment is informed by the motion of the hand in one case, so it is also by the motion of the eye in the other.

In (No. 13.) is exhibited the manner of seeing the same object  $ABC$ , by both the eyes  $D$  and  $E$  at once.

When any part of the image  $cba$  falls upon the optic nerve  $L$ , the corresponding part of the object becomes invisible. On which account, nature has wisely placed the optic nerve of each eye, not in the middle of the bottom of the eye, but towards the side next the nose; so that whatever part of the image falls upon the optic nerve of one eye, may not fall upon the optic nerve of the other. Thus the point  $a$  of the image  $cba$  falls upon the optic nerve of the eye  $D$ , but not of the eye  $E$ ; and the point  $c$  falls upon the optic nerve of the eye  $E$ , but not of the eye  $D$ : and therefore, to both eyes taken together, the whole object  $ABC$  is visible.

The nearer that any object is to the eye, the larger is the angle under which it is seen, and the magnitude under which it appears. Thus to the eye  $D$ , (No. 14.) the object  $ABC$  is seen under the angle  $APC$ ; and its image  $cba$  is very large upon the retina: but to the eye  $E$ , at a double distance, the same object is seen under the angle  $ApC$ , which is equal only to half the angle  $APC$ , as is evident by the figure. The image  $cba$  is likewise twice as large in the eye  $D$ , as the other image  $cba$  is in the eye  $E$ . In both these representations, a part of the image falls on the optic nerve, and the object in the corresponding part is invisible.

As the sense of seeing is allowed to be occasioned by the impulse of the rays from the visible object upon the retina of the eye, and forming the image of the object thereon, and that the retina is only the expansion of the optic nerve all over the choroides; it should seem surprising, that the part of the image which falls on the optic nerve should render the like part of the object invisible; especially as that nerve is allowed to be the instrument by which the impulse and image are conveyed to the common sensory in the brain. But this difficulty vanishes, when we consider that there is an artery within the trunk of the optic nerve, which entirely obscures the image in that part, and conveys no sensation to the brain.

That the part of the image which falls upon the middle of the optic nerve is lost, and consequently the correspond-

ing part of the object is rendered invisible, is plain by experiment. For, if a person fixes three patches,  $A, B, C$ , (No. 15.) upon a white wall, at the height of the eye, and the distance of about a foot from each other, and places himself before them, shutting the right eye, and directing the left towards the patch  $C$ , he will see the patches  $A$  and  $C$ , but the middle patch  $B$  will disappear. Or, if he shuts his left eye, and directs the right towards  $A$ , he will see both  $A$  and  $C$ , but  $B$  will disappear; and if he directs his eye towards  $B$ , he will see both  $B$  and  $A$ , but not  $C$ . For whatever patch is directly opposite to the optic nerve  $N$ , vanishes. This requires a little practice, after which he will find it easy to direct his eye, so as to lose the sight of whichever patch he pleases.

We are not commonly sensible of this disappearance, because the motions of the eye are so quick and instantaneous, that we no sooner lose the sight of any part of an object, than we recover it again; much the same as in the twinkling of our eyes; for at each twinkling we are blinded; but it is so soon over, that we are scarce ever sensible of it.

Some eyes require the assistance of convex glasses to make them see objects distinctly, and others of concave. If either the cornea  $abc$ , (No. 16.) or chrystalline humour  $e$ , or both of them, be too flat, as in the eye  $A$ , their focus will not be on the retina, as at  $d$ , where it ought to be, in order to render vision distinct; but beyond the eye, as at  $f$ . And therefore, those rays which flow from the object  $C$ , and pass through the humours of the eye, are not converged enough to unite at  $d$ ; and therefore the observer can have but a very indistinct view of the object. This is remedied by placing a convex glass  $gb$  before the eye, which makes the rays converge sooner, and imprints the image duly on the retina at  $d$ .

If either the cornea, or chrystalline humour, or both of them, be too convex, as in the eye  $B$ , the rays that enter it from the object  $C$ , will be converged to a focus in the vitreous humour; as at  $f$ , and by diverging from thence to the retina, will form a very confused image thereon: and so, of course, the observer will have as confused a view of the object, as if his eye had been too flat. This inconvenience is remedied by placing a concave glass  $gb$  before the eye; which glass, by causing the rays to diverge between it and the eye, lengthens the focal distance so; that if the glass be properly chosen, the rays will unite at the retina, and form a distinct picture of the object upon it.

Such eyes as have their humours of a due convexity, cannot see any object distinctly at a less distance than six inches; and there are numberless objects too small to be seen at that distance, because they cannot appear under any sensible angle. The method of viewing such minute objects is by a microscope; of which there are three sorts, *viz.* the single, the double, and the solar.

#### Of MICROSCOPES.

The single microscope is only a small convex glass, as  $cd$ , (No. 17.) having the object  $ab$  placed in its focus, and the eye at the same distance on the other side; so that the rays of each pencil, flowing from every point of the object on the side next the glass, may go on parallel

parallel to the eye after passing through the glass; and then, by entering the eye at *C*, they will be converged to as many different points on the retina, and form a large inverted picture *AB* upon it, as in the figure.

To find how much this glass magnifies, divide the least distance (which is about six inches) at which an object can be seen distinctly with the bare eye, by the focal distance of the glass; and the quotient will shew how much the glass magnifies the diameter of the object.

The *double or compound microscope*, (No. 18.) consists of an object-glass *cd*, and an eye-glass *ef*. The small object *ab* is placed at a little greater distance from the glass *cd* than its principal focus, so that the pencils of rays flowing from the different points of the object, and passing through the glass, may be made to converge and unite in as many points between *g* and *h*, where the image of the object will be formed: which image is viewed by the eye through the eye-glass *ef*. For the eye-glass being so placed, that the image *gh* may be in its focus, and the eye much about the same distance on the other side, the rays of each pencil will be parallel, after going out of the eye-glass, as at *e* and *f*, till they come to the eye at *k*, where they will begin to converge by the refractive power of the humours; and after having crossed each other in the pupil, and passed through the chrysaline and vitreous humours, they will be collected into points on the retina, and form the large inverted image *AB* thereon.

The magnifying power of this microscope is as follows. Suppose the image *gh* to be six times the distance of the object *ab* from the object-glass *cd*; then will the image be six times the length of the object: but since the image could not be seen distinctly by the bare eye at a less distance than six inches, if it be viewed by an eye-glass *ef*, of one inch focus, it will thereby be brought six times nearer the eye; and consequently viewed under an angle six times as large as before; so that it will be again magnified six times; that is, six times by the object-glass, and six times by the eye-glass; which multiplied into one another, makes 36 times; and so much is the object magnified in diameter more than what it appears to the bare eye; and consequently 36 times 36, or 1296 times, in surface.

But, because the extent or field of view is very small in this microscope, there are generally two eye-glasses placed sometimes close together, and sometimes an inch asunder; by which means, although the object appears less magnified, yet the visible area is much enlarged by the interposition of a second eye-glass, and consequently a much pleasanter view is obtained.

The *solar microscope*, (No. 19.) invented by Dr Lieberkhun, is constructed in the following manner. Having procured a very dark room, let a round hole be made in the window-shutter, about three inches diameter, through which the sun may cast a cylinder of rays *AA* into the room. In this hole, place the end of a tube, containing two convex glasses and an object, *viz.* 1. A convex glass *aa*, of about two inches diameter, and three inches focal distance, is to be placed in that end of the tube which is put into the hole. 2. The object *bb*, being put between two glasses (which must be concave to hold it at liberty)

is placed about two inches and a half from the glass *aa*. 3. A little more than a quarter of an inch from the object is placed the small convex glass *cc*, whose focal distance is a quarter of an inch.

The tube may be so placed, when the sun is low, that his rays *AA* may enter directly into it: but when he is high, his rays *BB* must be reflected into the tube by the plane mirror or looking glass *CC*.

Things being thus prepared, the rays that enter the tube will be conveyed by the glass *aa* towards the object *bb*, by which means it will be strongly illuminated; and the rays *d* which flow from it through the convex glass *cc*, will make a large inverted picture of the object at *DD*, which, being received on a white paper, will represent the object magnified in length, in proportion of the distance of the picture from the glass *cc*, to the distance of the object from the same glass. Thus, suppose the distance of the object from the glass to be  $\frac{1}{10}$  parts of an inch, and the distance of the distinct picture to be 12 feet or 144 inches, in which there are 1440 tenths of an inch; and this number divided by 3 tenths, gives 480; which is the number of times the picture is longer or broader than the object; and the length multiplied by the breadth, shews how much the whole surface is magnified.

#### OF TELESCOPES.

BEFORE we enter upon the description of telescopes, it will be proper to shew how the rays of light are affected by passing through concave glasses, and also by falling upon concave mirrors.

When parallel rays, as *abcdefgh*, (No. 20.) pass directly through a glass *AB*, which is equally concave on both sides, they will diverge after passing through the glass, as if they had come from a radiant point *C*, in the centre of the glass's concavity; which point is called the negative or virtual focus of the glass. Thus the ray *a*, after passing through the glass *AB*, will go on in the direction *kl*, as if it had proceeded from the point *C*, and no glass been in the way. The ray *b* will go on in the direction *mn*; the ray *c* in the direction *op*, &c.—The ray *C*, that falls directly upon the middle of the glass, suffers no refraction in passing through it; but goes on in the same rectilinear direction, as if no glass had been in its way.

If the glass had been concave only on one side, and the other side quite plane, the rays would have diverged, after passing through it, as if they had come from a radiant point at double the distance of *C* from the glass; that is, as if the radiant had been at the distance of a whole diameter of the glass's concavity.

If rays come more converging to such a glass, than parallel rays diverge after passing through it, they will continue to converge after passing through it; but will not meet so soon as if no glass had been in the way, and will incline towards the same side to which they would have diverged if they had come parallel to the glass. Thus the rays *f* and *g*, going in a converging state towards the edge of the glass at *B*, and converging more in their way to it than the parallel rays diverge after passing through it, they will go on converging after they pass through it, though

though in a less degree than they did before, and will meet at  $i$ : but if no glass has been in their way, they would have met at  $i$ .

When parallel rays, (No. 21.) as  $dfa$ ,  $Cmb$ ,  $etc$ , fall upon a concave mirror  $AB$  (which is not transparent, but has only the surface  $AbB$  of a clear polish,) they will be reflected back from that mirror, and meet in a point  $m$ , at half the distance of the surface of the mirror from  $C$  the centre of its concavity; for they will be reflected at as great an angle from a perpendicular to the surface of the mirror, as they fell upon it with regard to that perpendicular, but on the other side thereof. Thus, let  $C$  be the centre of concavity of the mirror  $AbB$ ; and let the parallel rays  $dfa$ ,  $Cmb$ , and  $etc$ , fall upon it at the points  $a$ ,  $b$ , and  $c$ . Draw the lines  $Cia$ ,  $Cmb$ , and  $Chc$ , from the centre  $C$  to these points; and all these lines will be perpendicular to the surface of the mirror, because they proceed thereto like so many radii or spokes from its centre. Make the angle  $Cab$  equal to the angle  $daC$ , and draw the line  $amb$ , which will be the direction of the ray  $dfa$ , after it is reflected from the point  $a$  of the mirror; so that the angle of incidence  $daC$ , is equal to the angle of reflection  $Cab$ ; the rays making equal angles with the perpendicular  $Cia$  on its opposite sides.

Draw also the perpendicular  $Chc$  to the point  $c$ , where the ray  $etc$  touches the mirror; and, having made the angle  $Cci$  equal to the angle  $Cce$ , draw the line  $cmi$ , which will be the course of the ray  $etc$ , after it is reflected from the mirror.

The ray  $Cmb$  passing through the centre of concavity of the mirror, and falling upon it at  $b$ , is perpendicular to it; and is therefore reflected back from it in the same line  $bmC$ .

All these reflected rays meet in the point  $m$ ; and in that point the image of the body which emits the parallel rays  $da$ ,  $Cb$ , and  $ec$ , will be formed; which point is distant from the mirror equal to half the radius  $bmC$  of its concavity.

The rays which proceed from any celestial object may be esteemed parallel at the earth; and therefore, the images of that object will be formed at  $m$ , when the reflecting surface of the concave mirror is turned directly towards the object. Hence, the focus  $m$  of parallel rays is not in the centre of the mirror's concavity, but half way between the mirror and that centre.

The rays which proceed from any remote terrestrial object, are nearly parallel at the mirror; not strictly so, but come diverging to it, in separate pencils, or, as it were, bundles of rays, from each point of the side of the object next the mirror; and therefore they will not be converged to a point at the distance of half the radius of the mirror's concavity from its reflecting surface, but into separate points at a little greater distance from the mirror. And the nearer the object is to the mirror, the farther these points will be from it; and an inverted image of the object will be formed in them, which will seem to hang pendant in the air; and will be seen by an eye placed beyond it (with regard to the mirror) in all respects like the object, and as distinct as the object itself.

Let  $AcB$ , (No. 22.) be the reflecting surface of a mirror, whose centre of concavity is at  $C$ ; and let the upright object  $DE$  be placed beyond the centre  $C$ , and send out a conical pencil of diverging rays from its upper extremity  $D$ , to every point of the concave surface of the mirror  $AcB$ . But to avoid confusion, we only draw three rays of that pencil, as  $DA$ ,  $Dc$ ,  $DB$ .

From the centre of concavity  $C$ , draw the three right lines  $CA$ ,  $Cc$ ,  $CB$ , touching the mirror in the same points where the foresaid rays touch it; and all these lines will be perpendicular to the surface of the mirror. Make the angle  $CAd$  equal to the angle  $DAC$ , and draw the right line  $Ad$  for the course of the reflected ray  $DA$ : make the angle  $Ccd$  equal to the angle  $DcC$ , and draw the right line  $cd$  for the course of the reflected ray  $Dd$ : make also the angle  $CBd$  equal to the angle  $DBC$ , and draw the right line  $Bb$  for the course of the reflected ray  $DB$ . All these reflected rays will meet in the point  $d$ , where they will form the extremity  $d$  of the inverted image  $ed$ , similar to the extremity  $D$  of the upright object  $DE$ .

If the pencil of rays  $Eg$ ,  $Eh$ , be also continued to the mirror, and their angles of reflection from it be made equal to their angles of incidence upon it, as in the former pencil from  $D$ , they will all meet at the point  $e$  by reflection, and form the extremity  $e$  of the image  $ed$ , similar to the extremity  $E$  of the object  $DE$ .

And as each intermediate point of the object, between  $D$  and  $E$ , sends out a pencil of rays in like manner to every part of the mirror, the rays of each pencil will be reflected back from it, and meet in all the intermediate points between the extremities  $e$  and  $d$  of the image; and so the whole image will be formed, not at  $i$ , half the distance of the mirror from its centre of concavity  $C$ ; but at a greater distance, between  $i$  and the object  $DE$ ; and the image will be inverted with respect to the object.

This being well understood, the reader will easily see how the image is formed by the large concave mirror of the reflecting telescope, when he comes to the description of that instrument.

When the object is more remote from the mirror than its centre of concavity  $C$ , the image will be less than the object, and between the object and mirror: when the object is nearer than the centre of concavity, the image will be more remote and bigger than the object: thus, if  $DE$  be the object,  $ed$  will be its image: for, as the object recedes from the mirror, the image approaches nearer to it; and as the object approaches nearer to the mirror, the image recedes farther from it; on account of the lesser or greater divergency of the pencils of rays which proceed from the object: for, the less they diverge, the sooner they are converged to points by reflection; and the more they diverge, the farther they must be reflected before they meet.

If the radius of the mirror's concavity, and the distance of the object from it, be known, the distance of the image from the mirror is found by this rule; Divide the product of the distance and radius by double the distance made less by the radius, and the quotient is the distance required.

If the object be in the centre of the mirror's concavity,

cavity, the image and object will be coincident, and equal in bulk.

If a man places himself directly before a large concave mirror, but farther from it than its centre of concavity, he will see an inverted image of himself in the air, between him and the mirror, of a less size than himself. And if he holds out his hand towards the mirror, the hand of the image will come out towards his hand, and coincide with it, of an equal bulk, when his hand is in the centre of concavity; and he will imagine he may shake hands with his image. If he reaches his hand farther, the hand of the image will pass by his hand, and come between his hand and his body: and if he moves his hand towards either side, the hand of the image will move towards the other; so that whatever way the object moves, the image will move the contrary.

All the while a by-stander will see nothing of the image, because none of the reflected rays that form it enter his eyes.

If a fire be made in a large room, and a smooth mahogany table be placed at a good distance near the wall, before a large concave mirror, so placed, that the light of the fire may be reflected from the mirror to its focus upon the table; if a person stands by the table, he will see nothing upon it but a longish beam of light: but if he stands at a distance towards the fire, not directly between the fire and mirror, he will see an image of the fire upon the table, large and erect. And if another person, who knows nothing of this matter before hand, should chance to come into the room, and should look from the fire towards the table, he would be startled at the appearance; for the table would seem to be on fire, and, by being near the wainscot, to endanger the whole house. In this experiment, there should be no light in the room but what proceeds from the fire; and the mirror ought to be at least fifteen inches in diameter.

If the fire be darkened by a screen, and a large candle be placed at the back of the screen; a person standing by the candle will see the appearance of a fine large star, or rather planet, upon the table, as bright as Venus or Jupiter. And if a small wax taper (whose flame is much less than the flame of the candle) be placed near the candle, a satellite to the planet will appear on the table: and if the taper be moved round the candle, the satellite will go round the planet.

In a *refracting telescope*, the glass which is nearest the object in viewing it is called the *object-glass*, and that which is nearest the eye is called the *eye-glass*. The object-glass must be convex, but the eye-glass may be either convex or concave: and generally, in looking through a telescope, the eye is in the focus of the eye-glass; though that is not very material: for the distance of the eye, as to distinct vision, is indifferent, provided the rays of the pencils fall upon it parallel: only, the nearer the eye is to the end of the telescope, the larger is the scope or area of the field of view.

Let  $cd$  (No. 23.) be a convex glass fixed in a long tube, and have its focus at  $E$ . Then, a pencil of rays  $ghi$ , flowing from the upper extremity  $A$  of the remote object  $AB$ , will be so refracted by passing through the glass, as to converge and meet in the point  $f$ ; whilst the pencil of rays  $klm$ , flowing from the lower extremity  $B$  of the

same object  $AB$ , and passing through the glass, will converge and meet in the point  $e$ : and the images of the points  $A$  and  $B$  will be formed in the points  $f$  and  $e$ . And as all the intermediate points of the object, between  $A$  and  $B$ , send out pencils of rays in the same manner, a sufficient number of these pencils will pass through the object-glass  $cd$ , and converge to as many intermediate points between  $e$  and  $f$ ; and so will form the whole inverted image  $eEf$  of the distinct object. But because this image is small, a concave glass  $no$  is so placed in the end of the tube next the eye, that its virtual focus may be at  $F$ . And as the pencils of rays pass converging through the concave glass, but converge less after passing through it than before, they go on further, as to  $b$  and  $a$ , before they meet; and the pencils themselves being made to diverge by passing through the concave glass, they enter the eye, and form the large picture  $ab$  upon the retina, whereon it is magnified under the angle  $bFa$ .

But this telescope has one inconveniency which renders it unfit for most purposes, which is, that the pencils of rays being made to diverge by passing through the concave glass  $no$ , very few of them can enter the pupil of the eye; and therefore the field of view is but very small, as is evident by the figure. For none of the pencils which flow either from the top or bottom of the object  $AB$  can enter the pupil of the eye at  $C$ , but are all stoppt by falling upon the iris above and below the pupil: and therefore, only the middle part of the object can be seen when the telescope lies directly towards it, by means of those rays which proceed from the middle of the object. So that to see the whole of it, the telescope must be moved upwards and downwards, unless the object be very remote; and then it is never seen distinctly.

This inconveniency is remedied by substituting a convex eye-glass, as  $gh$ , (No. 24.) in place of the concave one; and fixing it so in the tube, that its focus may be coincident with the focus of the object-glass  $cd$ , as at  $E$ . For then, the rays of the pencils flowing from the object  $AB$ , and passing through the object-glass  $cd$ , will meet in its focus, and form the inverted image  $mEp$ : and as the image is formed in the focus of the eye-glass  $gh$ , the rays of each pencil will be parallel, after passing through that glass; but the pencils themselves will cross in its focus on the other side, as at  $e$ : and the pupil of the eye being in this focus, the image will be viewed through the glass, under the angle  $geh$ ; and being at  $E$ , it will appear magnified, so as to fill the whole space  $CmepD$ .

But, as this telescope inverts the image with respect to the object, it gives an unpleasant view of terrestrial objects; and is only fit for viewing the heavenly bodies, in which we regard not their position, because their being inverted does not appear on account of their being round. But whatever way the object seems to move, this telescope must be moved the contrary way, in order to keep sight of it; for, since the object is inverted, its motion will be so too.

The magnifying power of this telescope is as the focal distance of the object-glass to the focal distance of the eye-glass. Therefore, if the former be divided by the latter, the quotient will express the magnifying power.

When we speak of the magnifying of a telescope or micro-

scope, it is only meant with regard to the diameter, not to the area nor solidity of the object. But as the instrument magnifies the vertical diameter, as much as it does the horizontal, it is easy to find how much the whole, visible area or surface is magnified: for, if the diameters be multiplied into one another, the product will express the magnification of the whole visible area. Thus, suppose the focal distance of the object-glass be ten times as great as the focal distance of the eye-glass; then, the object will be magnified ten times, both in length and breadth: and 10 multiplied by 10, produces 100; which shews, that the area of the object will appear 100 times as big when seen through such a telescope, as it does to the bare eye.

Hence it appears, that if the focal distance of the eye-glass were equal to the focal distance of the object-glass, the magnifying power of the telescope would be nothing.

This telescope may be made to magnify in any given degree, provided it be of a sufficient length. For, the greater the focal distance of the object-glass, the less may be the focal distance of the eye-glass; though not directly in proportion. Thus, an object-glass, of 10 feet focal distance, will admit of an eye-glass whose focal distance is little more than  $2\frac{1}{2}$  inches; which will magnify near 48 times: but an object-glass, of 100 feet focus, will require an eye-glass somewhat more than 6 inches; and will therefore magnify almost 200 times.

A telescope for viewing terrestrial objects, should be so constructed, as to shew them in their natural posture. And this is done by one object-glass  $cd$ , (No. 25.) and three eye-glasses  $ef$ ,  $gb$ ,  $ik$ , so placed, that the distance between any two, which are nearest to each other, may be equal to the sum of their focal distances; as in the figure, where the focus of the glasses  $cd$  and  $ef$  meet at  $F$ , those of the glasses  $ef$  and  $gb$  meet at  $l$ , and of  $gb$  and  $ik$  at  $m$ ; the eye being at  $n$ , in or near the focus of the eye-glass  $ik$ , on the other side. Then, it is plain, that these pencils of rays, which flow from the object  $AB$ , and pass through the object-glass  $cd$ , will meet and form an inverted image  $CFD$  in the focus of that glass; and the image being also in the focus of the glass  $ef$ , the rays of the pencils will become parallel, after passing through that glass, and cross at  $l$ , in the focus of the glass  $ef$ ; from whence they pass on to the next glass  $gb$ , and by going through it they are converged to points in its other focus, where they form an erect image  $EmF$  of the object  $AB$ : and as this image is also in the focus of the eye-glass  $ik$ , and the eye on the opposite side of the same glass; the image is viewed through the eye-glass in this telescope, in the same manner as through the eye-glass in the former one; only in a contrary position, that is, in the same position with the object.

The three glasses next the eye have all their focal distances equal: and the magnifying power of this telescope is found the same way as that of the last above; *viz.* by dividing the focal distance of the object-glass  $cd$ , by the focal distance of the eye-glass  $ik$ , or  $gb$ , or  $ef$ , since all these three are equal.

When the rays of light are separated by refraction, they become coloured; and if they be united again, they will be a perfect white. But those rays which pass

through a convex glass near its edges are more unequally refracted than those which are nearer the middle of the glass. And when the rays of any pencil are unequally refracted by the glass, they do not all meet again in one and the same point, but in separate points; which makes the image indistinct, and coloured, about its edges. The remedy is, to have a plate with a small round hole in its middle, fixed in the tube at  $m$ , parallel to the glasses. For, the wandering rays about the edges of the glasses will be stopt, by the plate, from coming to the eye; and none admitted but those which come through the middle of the glass, or at least at a good distance from its edges, and pass through the hole in the middle of the plate. But this circumscribes the image, and lessens the field of view, which would be much larger if the plate could be dispensed with.

The great inconvenience attending the management of long telescopes of this kind, has brought them much into disuse ever since the reflecting telescope was invented. For one of this sort, six feet in length, magnifies as much as one of the other an hundred. It was invented by Sir *Isaac Newton*, but has received considerable improvements since his time; and is now generally constructed in the following manner, which was first proposed by Dr *Gregory*.

At the bottom of the great tube  $TTTT$ , (No. 26.) is placed the large concave mirror  $DUVF$ , whose principal focus is at  $m$ ; and in its middle is a round hole  $P$ , opposite to which is placed the small mirror  $L$ , concave toward the great one; and so fixed to a strong wire  $M$ , that it may be moved farther from the great mirror, or nearer to it, by means of a long screw on the outside of the tube, keeping its axis still in the same line  $Pmn$  with that of the great one.—Now, since in viewing a very remote object, we can scarce see a point of it but what is at least as broad as the great mirror, we may consider the rays of each pencil, which flow from every point of the object, to be parallel to each other, and to cover the whole reflecting surface  $DUVF$ . But to avoid confusion in the figure, we shall only draw two rays of a pencil flowing from each extremity of the object into the great tube, and trace their progress, through all their reflections and refractions, to the eye  $f$ , at the end of the small tube  $tt$ , which is joined to the great one.

Let us then suppose the object  $AB$  to be at such a distance, that the rays  $B$  may flow from its lower extremity  $B$ , and the rays  $E$  from its upper extremity  $A$ . Then the rays  $C$  falling parallel upon the great mirror at  $D$ , will be thence reflected converging, in the direction  $DG$ ; and by crossing at  $I$  in the principal focus of the mirror, they will form the upper extremity  $I$  of the inverted image  $IK$ , similar to the lower extremity  $B$  of the object  $AB$ : and passing on to the concave mirror  $L$  (whose focus is at  $n$ ) they will fall upon it at  $g$ , and be thence reflected converging, in the direction  $gN$ , because  $gn$  is longer than  $gn$ ; and passing through the hole  $P$  in the large mirror, they would meet somewhere about  $r$ , and form the lower extremity  $B$  of the erect image  $AB$ , similar to the lower extremity  $B$  of the object  $AB$ . But by passing through the plano-convex glass  $R$  in their way, they form that extremity of the image at  $b$ . In like manner, the rays  $E$ , which come from the top of the object  $AB$ ,

$AB$ , and fall parallel upon the great mirror at  $F$ , are thence reflected converging to its focus, where they form the lower extremity  $K$  of the inverted image  $IK$ , similar to the upper extremity  $A$  of the object  $AB$ ; and thence passing on to the small mirror  $L$ , and falling upon it at  $b$ , they are thence reflected in the converging state  $bo$ ; and going on through the hole  $P$  of the great mirror, they would meet somewhere about  $q$ , and form there the upper extremity  $a$  of the erect image  $ab$ , similar to the upper extremity  $A$  of the object  $AB$ : but by passing through the convex glass  $R$  in their way, they meet and cross sooner, as at  $a$ , where that point of the erect image is formed.—The like being understood of all those rays which flow from the intermediate points of the object between  $A$  and  $B$ , and enter the tube  $TT$ ; all the intermediate points of the image between  $a$  and  $b$  will be formed; and the rays passing on from the image, through the eye-glass  $S$ , and through a small hole  $e$  in the end of the lesser tube  $tt$ , they enter the eye  $f$ , (which sees the image  $ab$  by means of the eye-glass) under the large angle  $ced$ , and magnified in length under that angle from  $c$  to  $d$ .

In the best reflecting telescopes, the focus of the small mirror is never coincident with the focus  $m$  of the great one, where the first image  $IK$  is formed, but a little beyond it (with respect to the eye) as at  $n$ : the consequence of which is, that the rays of the pencils will not be parallel after reflection from the small mirror, but converge so as to meet in points about  $g, e, r$ ; where they would form a larger upright image than  $ab$ , if the glass  $R$  was not in their way; and this image might be viewed by means of a single eye-glass properly placed between the image and the eye; but then the field of view would be less, and consequently not so pleasant; for which reason, the glass  $R$  is still retained, to enlarge the scope or area of the field.

To find the magnifying power of this telescope, multiply the focal distance of the great mirror by the distance of the small mirror from the image next the eye, and multiply the focal distance of the small mirror by the focal distance of the eye-glass; then, divide the product of the former multiplication by the product of the latter, and the quotient will express the magnifying power.

We shall here set down the dimensions of one of Mr. Short's reflecting telescopes, as described in Dr. Smith's optics.

The focal distance of the great mirror 9.6 inches, its breadth 2.3; the focal distance of the small mirror 1.5, its breadth 0.6; the breadth of the hole in the great mirror 0.5; the distance between the small mirror and the next eye-glass 14.2; the distance between the two eye-glasses 2.4; the focal distance of the eye-glass next the metals 3.8; and the focal distance of the eye-glass next the eye 1.1.

One great advantage of the reflecting telescope is, that it will admit of an eye-glass of a much shorter focal distance than a refracting telescope will; and, consequently, it will magnify so much the more: for the rays are not coloured by reflection from a concave mirror, if it be ground to a true figure, as they are by passing through a convex glass, let it be ground ever so true.

The adjusting screw on the outside of the great tube

fits this telescope to all sorts of eyes, by bringing the small mirror either nearer to the eye, or removing it farther; by which means, the rays are made to diverge a little for short-sighted eyes, or to converge for those of a long sight.

The nearer an object is to the telescope, the more its pencils of rays will diverge before they fall upon the great mirror, and therefore they will be the longer of meeting in points after reflection; so that the first image  $IK$  will be formed at a greater distance from the large mirror, when the object is near the telescope, than when it is very remote. But as this image must be formed farther from the small mirror than its principal focus  $m$ , this mirror must be always set at a greater distance from the large one, in viewing near objects, than in viewing remote ones. And this is done by turning the screw on the outside of the tube, until the small mirror be so adjusted, that the object (or rather its image) appears perfect.

In looking through any telescope towards an object, we never see the object itself, but only that image of it which is formed next the eye in the telescope. For if a man holds his finger or a stick between his bare eye and an object, it will hide part (if not the whole) of the object from his view. But if he ties a stick across the mouth of a telescope before the object-glass, it will hide no part of the imaginary object he saw through the telescope before, unless it covers the whole mouth of the tube: for, all the effect will be, to make the object appear dimmer, because it intercepts part of the rays. Whereas, if he puts only a piece of wire across the inside of the tube, between the eye-glass and his eye, it will hide part of the object which he thinks he sees: which proves, that he sees not the real object, but its image. This is also confirmed by means of the small mirror  $L$ , in the reflecting telescope, which is made of opaque metal, and stands directly between the eye and the object towards which the telescope is turned; and will hide the whole object from the eye at  $e$ , if the two glasses  $R$  and  $S$  are taken out of the tube.

#### Of the MULTIPLYING GLASS.

THE multiplying glass is made by grinding down the round side  $bik$  (No. 27.) of a convex glass  $AB$ , into several flat surfaces, as  $bb, bld, dk$ . An object  $C$  will not appear magnified when seen through this glass by the eye at  $H$ ; but it will appear multiplied into as many different objects as the glass contains plane surfaces. For, since rays will flow from the object  $C$  to all parts of the glass, and each plane surface will refract these rays to the eye, the same object will appear to the eye in the direction of the rays which enter it through each surface. Thus, a ray  $giH$ , falling perpendicularly on the middle surface, will go through the glass to the eye without suffering any refraction; and will therefore shew the object in its true place at  $C$ : whilst a ray  $ab$  flowing from the same object, and falling obliquely on the plane surface  $bb$ , will be refracted in the direction  $be$ , by passing thro' the glass; and upon leaving it, will go on to the eye in the direction  $eH$ ; which will cause the same object  $C$  to appear also at  $E$ , in the direction of the ray  $He$ , produced in the right line  $Hen$ . And the ray  $cd$ , flowing from

the

the object  $C$ , and falling obliquely on the plane surface  $dk$ , will be refracted (by passing through the glass and leaving it at  $f$ ) to the eye at  $H$ ; which will cause the same object to appear at  $D$ , in the direction  $Hfm$ .—If the glass be turned round the line  $glH$ , as an axis, the object  $C$  will keep its place, because the surface  $bdd$  is not removed; but all the other objects will seem to go round  $C$ , because the oblique planes, on which the rays  $ab$   $cd$  fall, will go round by the turning of the glass.

#### Of the CAMERA OBSCURA.

THE camera obscura is made by a convex-glass  $CD$ , (No. 23.) placed in a hole of a window-shutter. Then, if the room be darkened so, as no light can enter but what comes through the glass, the pictures of all the objects (as fields, trees, buildings, men, cattle, &c.) on the outside, will be shewn in an inverted order, on a white paper placed at  $GH$  in the focus of the glass; and will afford a most beautiful and perfect piece of perspective or landscape of whatever is before the glass, especially if the sun shines upon the objects.

If the convex glass  $CD$  be placed in a tube in the side of a square box, within which is the plane mirror  $EF$ , reclining backwards in an angle of 45 degrees from the perpendicular  $kg$ , the pencils of rays flowing from the outward objects, and passing through the convex glass to the plane mirror, will be reflected upwards from it, and meet in points, as  $I$  and  $K$  (at the same distance that they would have met at  $H$  and  $C$ , if the mirror had not been in the way,) and will form the aforesaid images on an oiled paper stretched horizontally in the direction  $IK$ ; on which paper, the out-lines of the images may be easily drawn with a black-lead pencil; and then copied on a clean sheet, and coloured by art, as the objects themselves are by nature.—In this machine, it is usual to place a plane glass, unpolished, in the horizontal situation  $IK$ , which glass receives the images of the outward objects; and their outlines may be traced upon it by a black-lead pencil.

*N. B.* The tube in which the convex glass  $CD$  is fixed, must be made to draw out, or push in, so as to adjust the distance of that glass from the plane mirror, in proportion to the distance of the outward objects; which the operator does, until he sees their images distinctly pointed on the horizontal glass at  $IK$ .

The forming a horizontal image, as  $IK$ , of an upright object  $AB$ , depends upon the angles of incidence of the rays upon the plane mirror  $EF$ , being equal to their angles of reflection from it. For, if a perpendicular be supposed to be drawn to the surface of the plane mirror at  $e$ , where the ray  $AaCe$  falls upon it, that ray will be reflected upwards in an equal angle with the other side of the perpendicular, in the line  $edI$ . Again, if a perpendicular be drawn to the mirror from the point  $f$ , where the ray  $Abf$  falls upon it, that ray will be reflected in an equal angle from the other side of the perpendicular, in the line  $fbI$ . And if a perpendicular be drawn from the point  $g$ , where the ray  $Acg$  falls upon the mirror, that ray will be reflected in an equal angle from the other side of the perpendicular, in the line  $giI$ . So that all the rays of the pencil  $abc$ , flowing from the upper extremi-

ty of the object  $AB$ , and passing through the convex glass  $CD$ , to the plane mirror  $EF$ , will be reflected from the mirror, and meet at  $I$ , where they will form the extremity  $I$  of the image  $IK$ , similar to the extremity  $A$  of the object  $AB$ . The like is to be understood of the pencil  $qrs$ , flowing from the lower extremity of the object  $AB$ , and meeting at  $K$  (after reflection from the plane mirror) the rays form the extremity  $K$  of the image, similar to the extremity  $B$  of the object: and so of all the pencils that flow from the intermediate points of the object to the mirror, through the convex glass.

#### Of the OPERA-GLASS.

If a convex glass, of a short focal distance, be placed near the plane mirror in the end of a short tube, and a convex glass be placed in a hole in the side of the tube, so as the image may be formed between the last mentioned convex glass and the plane mirror; the image being viewed through this glass, will appear magnified.—In this manner, the opera-glasses are constructed; with which a gentleman may look at any lady at a distance in the company, and the lady know nothing of it.

#### Of the Common LOOKING-GLASS.

THE image of any object that is placed before a plane mirror appears as big to the eye as the object itself; and is erect, distinct, and seemingly as far behind the mirror, as the object is before it: and that part of the mirror, which reflects the image of the object to the eye (the eye being supposed equally distant from the glass with the object) is just half as long and half as broad as the object itself. Let  $AB$  (No. 29.) be an object placed before the reflecting surface  $ghi$  of the plain mirror  $CD$ ; and let the eye be at  $o$ . Let  $Ab$  be a ray of light flowing from the top  $A$  of the object and falling upon the mirror at  $b$ , and  $bm$  be a perpendicular to the surface of the mirror at  $b$ ; the ray  $Ab$  will be reflected from the mirror to the eye at  $o$ , making an angle  $mbo$  equal to the angle  $Abm$ : then will the top of the image  $E$  appear to the eye in the direction of the reflected ray  $ob$  produced to  $E$ , where the right line  $ApE$ , from the top of the object, cuts the right line  $obE$ , at  $E$ . Let  $Bi$  be a ray of light proceeding from the foot of the object at  $B$  to the mirror at  $i$ ; and  $ni$  a perpendicular to the mirror from the point  $i$ , where the ray  $Bi$  falls upon it: this ray will be reflected in the line  $io$ , making an angle  $nio$ , equal the angle  $Bin$ , with that perpendicular, and entering the eye at  $o$ ; then will the foot  $F$  of the image appear in the direction of the reflected ray  $oi$ , produced to  $F$ , where the right line  $Bf$  cuts the reflected ray produced to  $F$ . All the other rays that flow from the intermediate points of the object  $AB$ , and fall upon the mirror between  $b$  and  $i$ , will be reflected to the eye at  $o$ ; and all the intermediate points of the image  $EF$  will appear to the eye in the direction of these reflected rays produced. But all the rays that flow from the object, and fall upon the mirror above  $b$ , will be reflected back above the eye at  $o$ ; and all the rays that flow from the object, and fall upon the mirror below  $i$ , will be reflected back below the

the eye at  $o$ : so that none of the rays that fall above  $b$ , or below  $i$ , can be reflected to the eye at  $o$ ; and the distance between  $b$  and  $i$  is equal to half the length of the object  $AB$ .

Hence it appears, that if a man sees his whole image in a plane looking-glass, the part of the glass that reflects his image must be just half as long and half as broad as himself, let him stand at any distance from it whatever; and that his image must appear just as far behind the glass as he is before it. Thus, the man  $AB$  (No. 30.) viewing himself in the plane mirror  $CD$ , which is just half as long as himself, sees his whole image as at  $EF$ , behind the glass, exactly equal to his own size. For, a ray  $AC$ , proceeding from his eye at  $A$ , and falling perpendicularly upon the surface of the glass at  $C$ , is reflected back to his eye, in the same line  $CA$ ; and the eye of his image will appear at  $E$ , in the same line produced to  $E$ , beyond the glass. And a ray  $BD$ , flowing from his foot, and falling obliquely on the glass at  $D$ , will be reflected as obliquely on the other side of the perpendicular  $abD$ , in the direction  $DA$ ; and the foot of his image will appear at  $F$ , in the direction of the reflected ray  $AD$ , produced to  $F$ , where it is cut by the right line  $BGF$ , drawn parallel to the right line  $ACE$ . Just the same as if the glass were taken away, and a real man stood at  $F$ , equal in size to the man standing at  $B$ : for to his eye at  $A$ , the eye of the other man at  $E$  would be seen in the direction of the line  $ACE$ ; and the foot of the man at  $F$  would be seen by the eye  $A$ , in the direction of the line  $ADF$ .

If the glass be brought nearer the man  $AB$ , as suppose to  $cb$ , he will see his image as at  $CDE$ : for the reflected ray  $CA$  (being perpendicular to the glass) will shew the eye of the image as at  $C$ ; and the incident ray  $Bb$ , being reflected in the line  $bA$ , will shew the foot of his image as at  $E$ ; the angle of reflection  $abA$  being always equal to the angle of incidence  $Bba$ : and so of all the intermediate rays from  $A$  to  $B$ . Hence, if the man  $AB$  advances towards the glass  $CD$ , his image will approach towards it; and if he recedes from the glass, his image will also recede from it.

#### Of the MAGIC LANTERN.

$ABCD$  (No. 31.) is a tin lantern, with a tube  $nklm$  fixed in the side of it. This tube consists of two joints, one of which slips into the other: and by drawing this joint out, or pushing it in, the tube may be made longer or shorter. At  $kl$  in the end of the moveable joint of the tube a convex lens is fixed, and an object painted with transparent colours upon a piece of thin glass is placed at  $de$  somewhere in the immoveable joint of the tube; so that as the tube is lengthened or shortened, the lens will be either at a greater or a less distance from this transparent object. In the side of the lantern there is a very convex lens  $bhc$ , which serves to cast a very strong light from the candle within the lantern upon the object  $de$ . Now when the rays, which shine through the object  $de$ , diverge from the several points  $a, d, e$ , &c. in the object, and fall upon the lens  $kl$ , they will be made to converge to as many points  $f, g$ , &c. on the other side of the lens, and will paint an inverted picture of the

object at  $fg$  upon a white wall, a sheet or a screen of white paper, provided the object is farther from the lens than its principal focus. To make this picture appear distinct and bright, it must have no other light fall upon it but what comes through the lens  $kl$ ; and for this reason the whole apparatus is to be placed in a dark room  $EFGH$ . The lens  $kl$  must be very convex, so that the object  $de$  may be very near to it, and yet not be nearer than its principal focus: for by this means, as the object is near to the lens, the picture  $fg$  will be at a great distance from it, and consequently the picture will be much bigger than the object. Since the picture is inverted in respect of the object, in order to make the picture appear with the right end upwards, it is necessary that the object  $de$  should be placed with the wrong end upwards.

#### Of the DIFFERENT REFRACTIBILITY of LIGHT.

We have hitherto supposed that a particle of light, as it comes from the sun, is the least particle into which light can be separated. But we must now correct this supposition, by shewing, that a particle of light, as it comes from the sun, is, properly speaking, a bundle of rays, which may be separated from one another. Therefore, for the future, by a ray of light we must be understood to mean, not that collection of particles which we have hitherto called by this name, but the least particles into which light can be separated.

*Rays of light are said to be differently refrangible, when at the same or equal angles of incidence some are more turned out of the way than others.*

*Rays are said to be differently reflexible, if some are more easily reflected than others.*

*Light is called homogeneous, when all the rays are equally refrangible: it is called heterogeneous, when some rays are more refrangible than others.*

*The colours of homogeneous light are called primary or simple colours; and those of heterogeneous light are called secondary or mixed.*

*The rays of the sun are not all equally refrangible: and those rays, which have a different degree of refrangibility, have likewise a different colour.*

If a beam of light  $SF$ , (No. 32.) that comes from the sun, passes into a dark room through  $F$  a round hole in a window shutter  $EG$ ; this beam proceeding straight forwards, and falling upon a paper at  $Y$ , would there make a round picture of the sun. This picture would be a confused one indeed, if the hole is a large one and there is no lens in the hole. However, as this round spot of light is a picture of the sun, we shall hereafter, notwithstanding its confusion, call it by this name. Now if a glass prism  $ABC$  is placed between the hole in the window-shutter and the paper at  $Y$ , the rays of this beam, by the refraction which they suffer in the prism, will be bent from their straight course, and instead of going on so as to fall upon the paper at  $Y$ , they will be turned upwards, and the picture of the sun produced by them will fall upon a paper  $MN$  that is placed above  $Y$ . If all the rays

were equally bent upwards, the picture would be a round one upon the paper MN, after the rays have been refracted, as well as when they passed straight forwards and fell upon a paper at Y. But this refracted picture PT is found to be oblong. The horizontal diameter or breadth of this oblong picture is equal to the diameter of the circular one Y: but the perpendicular diameter or height of the picture PT is much greater than its breadth. The refraction is made upwards, and not in a horizontal direction: therefore no alteration ought to be made in the breadth or horizontal diameter of the picture; because no refraction, that is not in the direction of that diameter, can make the picture either broader or narrower. And if all the rays were equally refracted upwards, such a refraction would not change the length of the picture; as it is round when it falls at Y, so it would be round when it is refracted upwards by the prism and falls at PT. This oblong picture consists therefore of rays, which are differently refrangible: they all fall at equal angles of obliquity upon BC the first side of the prism, but in the refraction some are more turned out of the way than others: those rays which go to P, the upper part of the picture, are the most refrangible; and those which go to T, the lower part of it, are least refrangible: the rest, which fall between P and T, have intermediate degrees of refrangibility.

This oblong picture is of different colours in different parts of it. The most refrangible rays at P are violet, the least refrangible at T are red; the rays of intermediate refrangibility from the violet downwards to the red are indigo-coloured, blue, green, yellow, and orange. So that the whole picture is made up of rays of these seven different colours. We may from hence see the reason why the coloured picture consisting of differently refrangible rays should be oblong, in such a manner that the two sides of it are right lines, and the two ends semicircles. For it consists (as in No. 32.) of seven circles, the highest of which PAGQ is violet, the lowest STN is red, the five intermediate ones, BH, CI, DK, EL, OM, are indigo coloured, blue, green, yellow, and orange. The white round picture Y, (No. 32.) is formed by heterogeneous rays, that are of seven different sorts, distinguished from one another by their different degrees of refrangibility and different colours. The refraction of the prism separates these rays from one another by refracting some of them more and others less. And consequently the refracted picture will consist of seven round pictures one below another. These round pictures are so near to each other, that the highest of them APGR will mix itself with some of those below it, as with BH and CQI. This nearness of these several round pictures to each other will prevent their colours from being distinctly seen; it will likewise make the sides AS, GN, which are composed of small arcs of circles very close to one another, appear like right lines; but the two ends P and T will be semicircles.

If the centres of these circles continue at the same distance from one another, and the circles themselves are made less, as *apq*, *bb*, *ci*, *dk*, *el*, *om*, *stn*, they will then be distinct or will not mix with each other; and as the colours of the several parts will by this means

be kept separate, so the refracted rays, instead of forming one continued oblong picture, will form seven small circular ones placed in a line perpendicular to the horizon. This separation of the several parts in the refracted picture from each other is brought about, (as in No. 34.) by making the hole F in the window-shutter very small, and by collecting the rays that come through it with a convex lens MN. For this will make a very small white picture of the sun at L, if there is no prism *abc*: but the refraction of this prism, if it is placed a little beyond the lens, will separate the heterogeneous rays by refracting them upwards; and instead of one small round and white picture at L, there will be seven small round pictures at PT, of which *r* will be violet, *s* indigo, *u* blue, *x* green, *y* yellow, *o* orange, and *z* red.

That the prism ABC (No. 32.) does not make the rays diverge, so as to spread over the space PT, upon any other account but their different refrangibility, will be evident, if (as in No. 35.) a second prism DH is placed beyond the first *abc*. For if the rays that come from S and pass through the hole F of the window shutter EG, were by the first prism *abc* made to diverge and form the oblong picture PT upon any other account besides their different refrangibility; then, supposing a second prism DH to be placed at right angles to the former, the effect must be this; the first prism *abc* makes the rays diverge from one another in a line PT perpendicular to the horizon, and consequently the second prism DH must make them diverge from one another in a line parallel to the horizon; so that the second prism would increase the breadth of the picture, as much as the first increased its length; and as one prism alone makes the picture a long one, both of them together would make it square, as *qrst*. But this second refraction does not alter the figure of the picture, but only the position of it: the second prism refracts the picture sideways; and those rays, which fell the highest at P after the first refraction, are refracted sideways the most by the second prism; those which fell the lowest at T are refracted sideways the least; by which means the picture, though it continues oblong, will not be perpendicular to the horizon as PT was, but will be inclined so as to lie in the position *pt*. This makes it evident, that the spreading of the rays by the first refraction was owing to their different refrangibility, and to no other cause. It must be owing to their different refrangibility, because those which were most refracted upwards by the first prism are most refracted sideways by the second. It cannot be owing to any other cause, because if it was, the second prism would spread the rays in breadth as much as the first prism spreads them in length, and both prisms would make the picture square.

*Those rays of light, which are most refrangible, are likewise most reflexible.*

When a beam of light is admitted into a dark chamber through the hole F in the window-shutter EG, (No. 36.) and this beam falls upon a prism ACB, the sides of which AC and AB are equal, and the angle at A a right one; when the obliquity of these rays, as they are to pass out of the prism at its base BC, is less than 40 degrees, the greatest part of the beam will pass out, but some few rays will

will be reflected at the surface BC. The rays, which pass through the base, form an oblong coloured picture HK, where MH is a more refrangible ray, and MK a less refrangible one. If the few rays of the beam, which are reflected from M in the direction MN, are made to pass through another prism XYV, they will likewise form an oblong coloured picture  $pt$ , where  $p$  is the most refrangible and  $t$  the least refrangible ray. This picture will be a very faint one, because there are but few rays reflected from M.

Now if the prism ACB is turned slowly round upon its axis in the direction ACB, the obliquity of the rays EM to the base BC will keep increasing, till at last this obliquity may become so great, that no rays will pass out at M, but all of them will be reflected. When this total reflection is made, the oblong picture  $pt$ , which was faint before, will become much brighter, because then not only a few rays, but all the beam, will be reflected thither. This total reflection will not be made all at once; but as the prism is turned slowly round upon its axis, the most refrangible rays MH will be first reflected, for the violet colour will disappear in the oblong picture HK, whilst all the other colours continue as bright as they were before; and when this colour disappears at HK, the same colour at  $p$  will become bright, and all the other colours at  $pt$  will continue as faint as they were before. When the prism is turned a little farther upon its axis, the indigo colour, which consists of rays that have the next greatest degree of refrangibility, will be reflected, so that this colour will disappear at HK and will become bright at  $pt$ . The same thing will happen to all the rays in their order; as the prism is turned round, each different sort of rays will be reflected sooner as the rays have a greater degree of refrangibility, or latter as they have a less degree. The red rays at K, which are the least refrangible of all, will be reflected last of all. From hence therefore it appears, that the rays of the sun are differently reflexible, and that those which are most refrangible are likewise most reflexible.

*Homogeneous light is refracted regularly without any dilatation or scattering of the rays.*

WHEN the rays of any one particular colour in the oblong picture of the sun, as the green rays, for instance, are separated from one another; if some of these green rays which are homogeneal, or are all equally refrangible, are transmitted through a very small round hole in a stiff pasteboard, and are refracted by a prism on the other side of the hole, the picture formed by these green rays after refraction upon a white paper held beyond the prism will not be oblong, but circular, as the hole is through which they passed. Therefore this homogeneous light is not dilated, nor are the rays of it scattered by this refraction.

*The confused appearance of objects, when they are seen through refracting bodies, is owing to the different refrangibility of light.*

IF flies, or the letters of a small print, or any other minute objects, are placed in heterogeneous light, such as a direct beam of the sun's, which has never been separated by any refraction into its homogeneous parts; these ob-

jects being viewed through a glass-prism will be seen confusedly, their edges will appear so misty that the smaller parts of minute animals cannot easily be distinguished from one another, and the letters of the small print cannot be read. But if the same objects are placed in a beam of homogeneous light, which is separated from all other rays of a different refrangibility in the manner already described, they will appear as distinct through a prism as if they were viewed with the naked eye. Therefore we may conclude, that this confusion is owing to the different refrangibility of those rays which come from the objects; since objects never appear confused when they are seen through refracting bodies, unless they are enlightened with several sorts of rays which have different degrees of refrangibility.

*It is probable that any single ray of the least refrangible sort contains a greater quantity of matter than any single ray of the most refrangible sort.*

WE have already seen, that at the same angles of incidence violet rays will be more refracted or more turned out of the way than red rays. And we have likewise seen, that rays are refracted when they pass out of one medium into another, by being either more or less attracted in one medium than they are in the other. Now since, when all other circumstances are equal, when red rays and violet rays fall at equal obliquities, and are to pass out of glass into air, so that the mediums, and consequently the attractive force or cause of refraction, is given; if the same cause can turn the violet rays more out of the way, or refract them more, than it does the red rays, these rays must have different moments; the most refrangible rays, or those which are most easily turned out of the way, have the least moment; and the least refrangible rays, or those which are most difficult to turn out of the way, have the greatest moment. But if all sorts of rays have the same velocity, their respective quantities of matter will be as their moments; and consequently any single ray of the most refrangible sort contains a less quantity of matter than any single ray of the least refrangible sort.

It may be upon this account that a red colour, or a pale purple, is less pleasant to the eye than a blue, green, or a yellow. The red rays strike the eye with so great a force as to be offensive to it; and the small force of the pale-purple ones will produce too faint a sensation to be agreeable. The intermediate colours are therefore more pleasant to the eye, as the force of the rays is neither too great to be offensive, nor too small to produce a quick and lively sensation.

*The colours of homogeneous light are so invariable, that neither any refraction nor any reflection can alter them.*

IF a beam of homogeneous light passes through a round hole in a pasteboard, and then is refracted by a prism on the other side of the hole, this refraction will make no alteration in the colour of the rays; if they were red, or whatever was their colour, before they entered the prism, their colour will still be the same, when they have passed through it, and fall upon a white paper held beyond the prism. This proves the first part of the proposition, that the

the colours of homogeneous light are to be changed by any refraction.

Red lead, when it is viewed in open day-light, or when heterogeneous rays fall upon it, will likewise be red, if it is placed in homogeneous red light: but red lead, when it is placed in any other sort of homogeneous light, will have the same colour with the rays that fall upon it and are reflected from it: if it is placed in yellow homogeneous light, it will be yellow; if in green light, it will be green; or if in blue light, it will be blue. Consequently the reflection of the rays from the red lead make no alteration in their colour; for if it did, rays of any sort reflected from the lead would be of the same colour, so that it would appear red in whatever sort of light it was placed. The same that is here said of red lead, is true of any other substance of any other colour. Grass, which is green either in open day-light or in homogeneous green light, will not change the colour of any homogeneous rays by reflecting them, but will itself have the same colour with the rays in which it is placed; it will be red in red light, or blue in blue light, or yellow in yellow light.

From hence we may conclude, by the way, that a body is of any particular colour, not because it reflects no other rays but those of that particular colour, but because it reflects those more copiously and others more sparingly. Red lead, as it appears red in red light, so in green light it appears green, or in blue light it appears blue: consequently it reflects rays of these sorts, and in the same manner it might be shewn to reflect all other sorts of rays. But then the red colour of red lead, when it is placed in red light, is much brighter than any other colour will be that it puts on by being placed in another sort of light: consequently it reflects red rays more copiously than any other sort of rays; and for this reason, when it is placed in open day-light, where it reflects all sorts of rays at once, the red rays are so much more numerous than the rest, as to make the whole mixture of their own colour.

*Colours may be produced by composition, which shall in appearance be like the colour of homogeneous light: but then these compound colours will be altered by refraction.*

WHEN, by means of two holes in the window-shutter of a dark room and of two prisms, two oblong coloured pictures are produced; if a circular piece of white paper is so placed that the red light of one picture and the yellow light of the other may fall upon it, this mixture will produce an orange colour, that in appearance will be like the primary orange colour. But between the simple and compound colour, though they are alike in appearance, there will be this difference; if the circular piece of paper, when it is enlightened with compound orange, is viewed through a prism, the rays will be found to be differently refrangible, and they will, by the refraction of the prism, be so separated from one another, that the paper seen through it will appear as two circles, one of which will be red and the other yellow; whereas, if the same paper, when it is enlightened with simple or primary orange, is viewed in like manner through a prism, the rays will be found to be equally refrangible, and the paper will appear through the prism, as it does to the naked eye, to be one

orange-coloured circle distinctly terminated all round. After the same manner other homogeneous colours, as blue and yellow, when mixed together, will produce a new compound colour like the intermediate homogeneous green colour in appearance. But then the rays of this compound green will not be all of them equally refrangible, as the rays of the simple or primary green colour are.

*The whiteness of the sun's light is compounded of all the primary colours mixed in a due proportion.*

LET the oblong coloured picture (No. 37.) fall upon the convex lens MN; and then all the rays which are separated from one another at PT will be collected together by passing through the lens, and will meet at its focus G, in such a manner as to form a round picture of the sun upon a white paper DE. This round picture, which consists of rays of all sorts, of red, orange, yellow, blue, green, indigo, and violet, is white. And this whiteness is compounded of all the primary colours mixed together. None of the rays change their colour by being mixed with the rest; each sort retains the same colour after it is mixed with the rest that it had before; neither the red rays, nor the orange, nor the yellow, nor the blue, nor the green, nor the indigo, nor the violet, are made white by being mixed with the rest at the focus; but though none of the parts are white, yet the whole mixture is white.

That the whiteness at the focus G arises from a mixture of all the primary colours, is evident. For if any of the colours are intercepted at the lens, the focus loses its whiteness, and becomes of that colour which arises from a mixture of those which are not intercepted. Thus if all the rays at PT are intercepted except the yellow, the orange, and the red, the focus will not be white, but will be orange-coloured. If all the rays are intercepted at PT, except the blue, the green, and the yellow, the focus will then be green. The orange in one case, and the green in the other case, is the compound colour arising from a mixture of those rays which are not intercepted. And in either case, if the rays that were intercepted are again suffered to pass through the lens, the focus will recover its whiteness.

It may be more difficult to shew that the rays, when they are all of them mixed at the focus, retain their proper colours, and are none of them white though the compound mixture is white. To make this out, let the paper be removed from DE, where all the rays are mixed upon it at G, to *de*, where it will receive the rays, after they have crossed one another at the focus, and having got beyond it diverge again. In this position of the paper, because the rays that were mixed at the focus have diverged from thence, and are again separated from one another, the oblong coloured picture will appear again at *tp*, so that the red colour T, which was the lowest at the lens, will be the highest at the paper *de*. But though the colours are thus inverted by passing the focus, yet all of them appear at *tp*; which would have been impossible, if each sort of rays, by being mixed with the rest at the focus, had lost their colour, and had been made white. Nor indeed is the colour of any sort of rays at all changed by being mixed with the rest at the focus; but the

the same rays that produced any particular colour in the oblong picture *PT* are the rays that produce the same colour in the inverted picture *tp*; as would be evident from intercepting any particular colour at *PT*: for if the green rays, for instance, are intercepted at *PT*, there will be no green at *tp*: or if the red are intercepted at *PT*, there will then appear no red colour at *tp*: and the same thing will happen upon intercepting the rays of any other colour at *PT*, for then that colour will vanish at *tp*.

*Colours may be produced by composition that are neither exactly like any of the primary ones, nor fully white.*

If the red rays of one coloured picture are mixed with the violet rays of another, according to the various proportions in which they are mixed, various purples will be produced, such as are not like in appearance to the colour of any homogeneous light; and of these purples, mixed with yellow and blue, may be made other new colours.

By mixing the coloured powders which painters use, though the powders themselves resemble the primary colours, yet the mixture may be grey, or dun, or russet-brown, such as are the colours of a man's nail, of a mouse, of ashes, of ordinary stones, of mortar, of dust and dirt in the high-ways. Thus one part of red lead, and five of viride æris, compose a dun colour like that of a mouse. If to orpiment, which is yellow, a full bright purple powder used by painters is added, the mixture may be made of a pale red; and with the addition of a little viride æris, which, as the name imports, is green, and of a little blue bise, this pale red will change to grey or pale white, such as is the colour of ashes, or of wood newly cut, or of a man's skin.

These grey, dun, and russet colours are only imperfect sorts of white. And we may understand, why the mixture of these coloured powders should produce an imperfect white, and not a full bright one, from the following observation. All coloured powders suppress and stop great part of the light that falls upon them: they reflect more of those rays from whence their colour arises than of any other sort; but they reflect even those more sparingly than white bodies do. Red lead, for instance, reflects fewer red rays than white paper does; for if red lead and white paper are both of them placed in homogeneous red light, the paper will appear of a brighter red than the lead. But if red lead suppresses many red rays, it may well be supposed to suppress many more rays of other colours; since its redness is owing to its reflecting red rays more copiously, and all other rays more sparingly. From hence it follows, that in a mixture of coloured powders, though they reflect rays of all sorts in a due proportion, so that the compound light will not be more of one colour than another, but will be white; yet the whiteness will be much less bright than that of paper; because the mixture of powders suppresses and stops many rays, whereas the paper reflects almost all the rays that fall upon it, and suppresses scarce any. Thus the whiteness in the mixture of powders, and the whiteness in the paper, are both of the same sort, and differ from one another only in degree, or in the quantity of light. Therefore, if some of this mixture of powders is placed in bright sunshine, and a piece of white paper is placed in the shade, the mixture by thus

increasing the light, and the paper by thus diminishing it, may be made to appear equally white.

*The colours of all bodies are either the simple colours of homogeneous light, or such compound colours as arise from a mixture of homogeneous light.*

EACH sort of light has a peculiar colour of its own, which no refraction or reflection can change. Therefore the colour of no natural body can be any other than either the colour of some sort of homogeneous light, or a compound colour arising from a mixture of the several sorts. For bodies appear coloured only by reflecting light; and no reflection can give any other colours to the rays but what they had before.

*Of the COLOURS of THIN TRANSPARENT PLATES.*

*Water, air, glass, or any other transparent substance, when drawn out into thin plates, become coloured.*

WATER, when it is made tenacious by having soap mixed with it, may be blown up into a bubble *A*, (No. 38.) such as children play with. If this bubble is set under a glass, so that the motion of the air may not affect it, then as the water glides down the sides of it, and the top of it at *A* grows thinner, several colours will successively appear at *A*, and will spread themselves from thence in rings surrounding *A*, and descending farther and farther down the sides of the bubble, till they vanish at *BC* in the same order in which they appeared. Thus, for instance, the first colour that appears at *A*, the top of the bubble, is red: this red spot spreads itself into a circular ring round *A*, and then the top of the bubble *A* becomes blue: this blue spot spreads itself in the same manner round *A*, and then *A* becomes red a second time. Before we go on to consider what other colours arise at *A*, we will observe what becomes of those which arise first. The red, which first appeared at *A*, spreads itself into a circular ring round *A*: this ring grows larger, as the water glides down the sides of the bubble; so that the coloured ring glides down the bubble along with the water, till it sinks at last to *BC*, and there encompasses the bubble. In like manner the blue, which arises at *A* after the red, spreads itself and descends down the bubble, as the red ring did. The colour which arises next at *A*, is red a second time; this spreads itself in the same manner, and is succeeded by blue a second time. These are followed by a great variety of colours, which appear successively at *A*, and spread themselves from thence in this order: Red, yellow, green, blue, purple; then again red, yellow, green, blue, violet; and lastly, red, yellow, white, blue. This last blue colour is succeeded at *A* by a black spot, which reflects scarce any light: this spot dilates itself, but not into a circular ring as the colours had done; it becomes broader and broader, till the bubble breaks.

A thin plate of water of the same sort with this bubble, but more lasting, may be otherwise procured. If a piece of plane polished glass is placed upon the object-glass of a long telescope, as in (No. 39.) the plane surface of one glass, and the convex one of the other, will touch one another only at a single point; and if the interval between them is filled with water, as the glasses are pressed together, the same colours arise at the point of contact

contact, and spread themselves in circular rings round it in the same order as in the soap-bubble. If BC (No. 40.) is a section of the plane glass, and DAE a section of the convex one; when they are pressed close together, the thin plate of water that fills the interval between them will have a black spot at A; and this spot will be encompassed with rings of colours, in the same order that they stand in that figure upon the line BC, on each side of A. If the colours are reckoned in the order in which they stand on the plate of water after the black spot appears at A, and we reckon them from the spot A towards the edges of the plate at B and C; then we must call blue the first colour. But if we reckon them in the order in which they arose at A, and spread themselves; then we must begin from B or C, the edges of the plate, and go on towards A, and in this reckoning we must call red the first colour.

If there is no water between the two glasses, then the interval will be filled with air, and this thin plate of air will have the same colours that the plate of water had; with this difference only, that each of the coloured rings is larger in the plate of air than in the plate of water.

When glass is blown very thin at a lamp-furnace, thin plates of it thus formed will exhibit colours; and so likewise will thin plates of Mucovy-glasses. Metals, when they are heated, send out to their surfaces scoria or vitrified parts, which cover the metals in form of a thin skin; and these scoria or thin plates cause colours upon the surface of the metal, such as are made to appear on polished steel by heating it, or on bell-metal by melting it first and then pouring it on the ground to cool in the air.

*When the thin plate is denser than the medium that surrounds it, the colours are more vivid than they are when the plate is rarer than that medium.*

A thin bubble is a plate of water encompassed with air; where the substance of the plate, which is water, is denser than the air, which is the medium that surrounds it. On the contrary, the plate of air between the two glasses BAC, DAE, (No. 40.) is encompassed with glass; and here the substance of the plate is rarer than that of the circumambient medium; and the colours on the bubble of water are more vivid than those on the thin plate of air.

*When thin transparent plates reflect one sort of rays, they transmit the rest.*

If the plate of air between the two glasses BAC, DAE, (No. 40.) is viewed by reflected light, the colours of it are those expressed on the upper part of the figure from B to C; but if we look through it, that is, if we view it by transmitted light, or if the transmitted light falls upon a white paper, the colours that we see through the plate, or that fall on the paper, are those expressed on the lower part of the figure. Now, any of the transmitted colours are what would arise from a mixture of all the remaining rays, after those of the reflected colour are separated from the sun's heterogeneous light. Thus, for instance, the fourth reflected colour from the black spot A inclusively is yellow, the transmitted colour is violet. The yellow rays, and some of the orange and green, are reflected here, so that the mixture of the reflected light will be yellow. The mixture of the transmitted light therefore will be violet, or

rather such a purple as is not exactly like any of the primary colours; for we observed, that from red rays, violet, and blue, new purples may be produced.

This is the case in some natural bodies, as well as in these transparent artificial plates; for if leaf-gold, which is made thin enough to transmit light, is held against the strong light of the sun's rays, the gold, which is yellow when seen by the reflected light, will be blue when thus seen by transmitted light.

The seventh reflected colour inclusively from the black spot is blue, the seventh transmitted colour is yellow. When the rays which make the blue colour are taken out of the sun's heterogeneous light, the remaining rays will be yellow. Thus it happens likewise in some natural bodies; for an infusion of lignum nephriticum, which is blue when seen by reflected light, is yellow when seen by transmitted light.

The black spot A reflects scarce any light; and as rays of all colours are transmitted there, the transmitted colour is white; the third reflected colour from the black spot inclusively is white. Therefore, since all the rays are reflected there, no colour ought to be seen there, when we look through the plate; and accordingly that part of the plate is black.

Hence we see the reason why, if there be two liquors of full colours in two different glass vessels, suppose red and blue; though each is transparent when we look thro' it separately, yet we should not be able to see through both of them together, if one was held behind the other. For if the blue liquor, for instance, is held towards the light, and the red towards the eye; since only blue rays pass through the first liquor, and come to the second; and since the second liquor will transmit no blue rays, but only red ones; it follows, that no rays at all can come to the eye.

Indeed some transparent bodies appear of the same colour, whether we see them by reflected or transmitted light. Of this sort is most painted glass. But when this is the case, the coloured rays are reflected from the second surface of the body. Thus, if a piece of painted glass is yellow either when seen by reflected light or when seen by transmitted light, all the rays but the yellow ones are suppressed as they pass through the glass: of the yellow rays, most are transmitted at the second surface; the few which are reflected from thence will be sufficient to tinge all the light yellow, which is reflected from the first surface. This will be evident from making the body thick, and pitching it on the backside: for by this means the reflected colour will be lost; whereas, if it had been reflected from the first surface, the pitch at the second surface could not have altered it.

*The more dense the substance is out of which a thin plate is made, the less is the thickness of the plate where it reflects any certain colour.*

The colours are the same whether there is air or water between the two glasses BAC, DAE, (No. 40.) only the coloured circles are smaller in the plate of water than in the plate of air. Thus the yellow, for instance, which is the fourth coloured circle from the black spot, is a less circle, or is nearer to the black spot, when there is a plate of water between the glasses, than when there is a plate

plate of air between them. But the less the distance from the point of contact A, the closer the glasses are to one another, and consequently the thinner will be the plate that lies between them; consequently that part of a plate of water where this yellow appears, is thinner than that part of a plate of water where the same colour appears. And the same holds good in any other colour. But water is more dense than air: therefore, the more dense the substance is out of which a thin plate is made, the less is the thickness of the plate where it reflects any certain colour.

*The sort of colour, which is reflected from any part of a thin plate, depends only upon the thickness of the plate itself in that part: but the same colour will be made less vivid by increasing the density of the medium with which the plate is encompassed.*

The colours upon any part of a thin plate of Muscovy glass are the same in sort, whether the plate is dry or wetted with water. Therefore the sort of colour in any part depends not upon the medium that encompasses the plate, but upon the thickness of the plate itself; since the colours are the same when the plate is dry and encompassed with air, or wet and so encompassed with water. But the same colours are more faint when the plate is wet, than when it is dry; and consequently, the brightness of the colours does depend upon the medium that encompasses the plate; and the denser that medium is, the fainter will be the colours; they are more faint when the plate is covered with water than when it is dry and so is surrounded with air.

*The rays of light have alternate fits of easy reflection and easy transmission, which return at equal intervals.*

Let GF, (No. 41.) be a beam of homogeneous light consisting all of one sort of rays, as suppose all the rays that compose the beam were red ones. Then, if these rays fall upon a thin plate of air between the two glasses BAC, DAE, at A there will be a dark spot, and all the rays will be transmitted: round this spot there will be a red ring, where all the rays are reflected; round this red ring there will be a dark ring, where all the rays are transmitted. And if the thickness of of the plate where all the rays are reflected in the ring nearest to A is called 1, the thickness where the dark ring appears and all the rays are transmitted will be 2. Again, at that part of the plate where the thickness is 3, all the rays will be transmitted: at the thickness 4, they will be all reflected. And thus alternately, as expressed by the lines in the figure, the rays will be reflected in all parts of the plate where the thickness is expressed by any of the uneven numbers 1, 3, 5, 7, 9, &c. and will be transmitted where the thickness is expressed by any of the even numbers 2, 4, 6, 8, 10, &c.

Now as the plate is the same in all parts, the cause of this alternate reflection and transmission must be in the rays themselves; and their dispositions to be thus alternately reflected and transmitted, are what we call fits of easy reflection and easy transmission.

The rays that are in a fit of easy reflection penetrate as far as the second surface of the plate. For if the se-

cond surface of a thin plate of Muscovy glass is wetted, the colours caused by the alternate reflection grow fainter; whereas if the reflection was made at the first surface, wetting the second could not affect the colours. But since those rays which have passed from the first surface of the plate to the second where the thickness of it is 1, are reflected, and those which have passed from the first surface to the second where the thickness of it is 2, are transmitted; and then again those which have thus passed from one surface to the other, where the thickness is 3, are reflected; and those which have passed in the same manner, where the thickness is 4, are transmitted; it follows, that the fits of easy reflection and transmission return at equal intervals. So that, if a ray was to set out from A in the line AB, (No. 42.) and was to be in a fit of easy reflection when it had moved from A to c, it would be in a fit of easy transmission when it had moved to twice that distance from A, or when it was got to d: at e, or the distance 3 from A, it will be in a fit of easy reflection; at f, or the distance 4, in a fit of easy transmission; at g, or 5, in a fit of easy reflection; at B, or 6, in a fit of easy transmission: and thus, in the farther progress of the ray, the same fits will return at equal intervals.

Thus if the thickness of the plate of air, where the rays of any homogeneous colour are all reflected, is equal to Ac or 1, and the rays are in a fit of easy reflection when they come to the second surface of the plate; then, where the thickness of the plate is Ad or 2, the rays will be in a fit of easy transmission when they come to the second surface, and consequently will all pass through that surface. Again, where the thickness is Ae or 3, the rays, when they come to the second surface, will be in a fit of easy reflection, and will all be reflected; where the thickness is Af or 4, the fit of easy transmission will be returned when the rays come to the second surface, so that all of them will be transmitted. And in like manner, by such fits returning at equal intervals, the rays will be reflected where the thickness is expressed by the number 1, 3, 5, 7, 9, &c. and will be transmitted where it is expressed by 2, 4, 6, 8, 10, &c.

*When a thin coloured plate is viewed obliquely, the colours of every part in the plate will be altered.*

When a bubble of water or a plate of air between two glasses BAC, DAE, (No. 40.) is viewed obliquely, the coloured rings dilate themselves: and consequently a ring of any one colour, by being dilated, gets into that part of the plate where a ring of some other colour appeared when the plate was viewed directly.

*If the plate is denser than the medium that encompasses it, the colours of it, when viewed obliquely, change less than they would if the plate was rarer than the medium that encompasses it.*

A bubble of water is a thin plate denser than the air that encompasses it: and a plate of air between the two glasses BAC, DAE, (No. 48.) is rarer than the glass that encompasses it. Upon viewing each of these thin plates obliquely, the coloured rings on the plate of water dilate less than those on the plate of air. Therefore, since it is by this dilation of the rings that a ring of

One colour gets into a part of the plate where a ring of some other colour appeared when the plate was viewed directly; that is, since it is by this dilatation of the rings that the several parts of the plates change their colours; it follows, that any part of a plate of water encompassed with air changes colour less upon being viewed obliquely, than any part of a plate of air encompassed with glass.

*When the medium which encompasses a coloured transparent plate is given, the colours change less upon altering the situation of the eye, as the substance is more dense out of which that plate is made.*

The matter out of which a bubble of water is made is not so dense as that out of which a bubble of glass is made, and glass is not so dense as the scoria or glassy ston thrown out by metals when they are heated. Now, any of these plates either of water, or glass, or metallic substance, when they are encompassed with the same medium air, will change their colour a little upon being viewed obliquely; but the plate of water changes the most, the plate of glass less than that, and the scoria of metals least of all.

*Of the OPAKENESS, TRANSPARENCY, and COLOURS of NATURAL BODIES.*

*The opakeness of bodies is owing to the many reflections and refractions which the rays of light suffer within those bodies.*

THE smallest parts of almost all natural bodies are transparent, as will readily be granted by those who have been used to look through microscopes. A piece of leaf-gold is transparent if it is held up against the hole of a window-shutter in a dark room; and any other substance, however opaque it may seem in the open air, will appear transparent by the same means, when it is made of a sufficient thinness. Even metals become transparent, if they are dissolved in a proper menstruum, as gold in aqua regia, or silver in aqua fortis; and by being thus dissolved, are reduced to very small particles. But since even in opaque bodies every single particle transmits light, or is transparent, the whole would likewise transmit light, unless the rays, when they are to pass through all the particles which make up the whole, were so turned out of the way by innumerable refractions and reflections, as to be stopped and suppressed in their passage. That this is the reason why bodies that consist of transparent particles should be opaque, is evident; since opaque bodies, when they are reduced to a sufficient thinness, become transparent: for then there will be but few particles lying beyond one another for the light to pass through; and as the rays will suffer fewer refractions and reflections, some of them may get through a thin plate, though all of them would be suppressed in a thicker mass of the same substance.

*The medium, with which the pores of opaque bodies are filled, is not of the same density with the particles of those bodies.*

BODIES consist of transparent particles, and their opakeness is owing to the many reflections and refractions which the light suffers within them. Now, if the interstices between the particles of any body were filled with

a medium of the same density with the particles, the light would neither be refracted nor reflected as it passed out of the particles into the interstices and out of the interstices into the pores, but would pass through the body, and the body would be transparent. Consequently, in an opaque body, where the light is suppressed by the refractions and reflections which it suffers, the particles that compose the body, and the medium that fills the pores or interstices between the particles, must be of different densities.

Hence we may see the reason why paper, when it has been dipped in water or oil, is more transparent than when it is dry. For when the paper is thoroughly wetted with water or oil, the pores of it are filled with a medium that is nearly of the same density with its particles: On the contrary, though oil of turpentine and water are both of them transparent when they are separate; yet if they are shaken together so as to mix but imperfectly, the mixture becomes much less transparent, because the parts of each fluid are separated from one another, and those of the other fluid, which are of a different density, get in between them.

*The parts of bodies, and their interstices, must not be less than of a certain definite bigness to render them opaque and coloured.*

THE most opaque bodies become transparent when their particles are subtilly divided; as metals, such as gold or silver, which are opaque in large masses, become transparent when the former is dissolved in aqua regia, and the latter in aqua fortis. And we observed, that at the top of a bubble of water, where the water is extremely thin, there is a black spot, which reflects scarce any light at all; though the water is encompassed with air, which is a medium of a different density. Consequently, if the diameter of the particles of which any natural substance consists was no greater than the thickness of the bubble, where it reflects no light, but transmits all, such a body would be transparent, notwithstanding the interstices that are between its particles were filled with a medium the density of which is different from theirs.

In like manner, we observed, that when a thin plate of air lies between two pieces of glass BAC, DAE, (No 40.) there is a dark spot, which reflects no light, and transmits all, not only at the point A where the glasses touch one another, but also round that point to some distance where the glasses are very near to one another. From hence we may conclude, that though the particles of any natural substance were as dense as glass, and the medium which fills their interstices was as rare as air; yet if these interstices were no bigger than the interval between the two glasses BAC, DAE, at that place where all light is transmitted, such a body would be transparent.

The transparency of water seems to be owing to the causes here mentioned, to the smallness of its parts, or of its pores, or of both. For we are sure that the pores of water are filled with air, because the air may be drawn out from the water in an air-pump; and consequently, as the pores are filled with a medium of a different density from the parts, the mixture ought to be opaque, like such a mixture of water and oil of turpentine as was mentioned above. But the smallness either of the parts,

or of the interstices, or of both, will prevent the mixture from being opaque.

Since therefore all bodies will be transparent, if either their parts or their interstices are too small, it follows that the parts, and likewise the pores, of such bodies as are not transparent but opaque and coloured, must not be less than of a certain and determinate bigness.

*The colours of natural bodies depend upon the size of their particles.*

DIFFERENT parts of thin transparent plates, according to the different thickness of them, are of different colours. Now if any part of such a thin plate of glass, for instance, where it appears of one uniform colour, should be split into threads, or broken into small particles, all these particles would make a heap of powder of the same colour. And the small particles of natural bodies, since they are transparent, like so many fragments of a thin plate, must exhibit colours in the same manner.

*The parts of bodies, on which their colours depend, are much denser than the medium which fills their pores.*

FOR where the transparent plate or particle consists of a rarer substance than the medium that encompasses it, the colours are less vivid than those of natural bodies commonly are. For this reason it is that the colours of silks or cloths, when they are wetted with oil or water, become more faint; because these liquors are more nearly of the same density with the particles, than the medium is which fills the interstices when they are dry. Besides, the colours upon a transparent plate change very sensibly, unless the plate consists of a substance much denser than the medium that encompasses it; but most natural bodies are of the same colour in whatever position of the eye they are viewed. Therefore their transparent particles, upon which their colours depend, are much denser than the medium which encompasses those particles or fills the interstices between them.

Nor is the case otherwise even in those bodies which do change colour upon being viewed obliquely, such as changeable silks, or the feathers of a peacock's tail or of a pigeon's neck. For this change of colour, upon the situation of the eye being changed, is no reason for concluding that the medium which fills the interstices or pores is more nearly of the same density with the particles, upon which the colours depend, in these bodies than in others; since the change of colour is plainly owing to our seeing a different part of the body in different positions of the eye. Thus, in changeable silks, the warp is of one colour, and the woof of another; and in one position of the eye more of the warp is seen, and in another position of it more of the woof is seen. In like manner, if a pigeon's neck appears blue in one position of the eye, and crimson in another, it is because in these different positions we see different parts of the same feathers.

*We cannot from the colour of a body make any conjecture about the size of the particles upon which its colours depend.*

SUPPOSE, from the appearance of the colour in any yellow body, that we had determined its yellow to be of the same sort with that which is next to the black spot

in a plate of air, or water, or glass. The thickness of a plate, where it appears of this colour, is different according to the different density of the substance out of which that plate is made; the thickness of a plate of air where it appears of this colour, is greater than that of a plate of water were it appears of the same colour, and much greater still than that of a plate of glass. Suppose therefore farther, that we were able to determine exactly what is the thickness of a plate of air or water or glass, where each of them is tinged with the same yellow colour that any natural body exhibits; yet we cannot determine whether the diameter of the particles, upon which this body's colour depends, is equal to the thickness of the plate of air, or of water, or of glass, unless we could first determine whether the density of those particles is equal to the density of air, or to that of water, or to that of glass: since the particles must be larger, if their density is equal to the density of air, than if it is equal to the density of water; and larger, if it is equal to that of water than if it is equal to that of glass. And indeed we have good reason to conclude, that the density of the parts, upon which the colours of natural bodies depend, is greater even than that of glass; and consequently that the diameter of those parts is much less than the thickness of a plate of glass, where it appears of the same colour with the body. For, upon being viewed obliquely, thin plates of glass change colour, whereas natural bodies do not: and the colour of natural bodies is made more unchangeable than that of thin plates of glass, by their particles being more dense than glass.

#### *Of the RAINBOW.*

*When the rays of the sun fall upon a drop of rain and enter into it, some of them, after one reflection and two refractions, may come to the eye of a spectator who has his back towards the sun and his face toward the drop.*

IF XY (No. 43.) is a drop of rain, and the sun shines upon it in any lines *sf, sd, sa*, &c. most of the rays will enter into the drop: some few of them only will be reflected from the first surface; those rays, which are reflected from thence, do not come under our present consideration, because they are never refracted at all. The greatest part of the rays then enter the drop, and those passing on to the second surface will most of them be transmitted through the drop; but neither do these rays which are thus transmitted fall under our present consideration, since they are not reflected. For the rays, which are described in the proposition, are such as are twice refracted and once reflected. However, at the second surface, or hinder part of the drop, at *pg* some few rays will be reflected, whilst the rays are transmitted: those rays proceed in some such lines as *nr, nq*; and coming out of the drop in the lines *rv, qt*, may fall upon the eye of a spectator, who is placed any where in those lines, with his face towards the drop, and consequently with his back towards the sun, which is supposed to shine upon the drop in the lines *sf, sd, sa*, &c. These rays are twice refracted, and once reflected: they are refracted, when they pass out of the air into the drop; they are reflected from the second surface, and are refracted again, when they pass out of the drop into the air.

When rays of light reflected from a drop of rain come to the eye, those are called effectual which are able to excite a sensation.

When rays of light come out of a drop of rain, they will not be effectual, unless they are parallel and contiguous.

THERE are but few rays that can come to the eye at all: for the greatest part of those rays which enter the drop  $xy$  ( $N^{\circ} 43$ .) between  $x$  and  $a$ , pass out of the drop thro' the hinder surface  $pg$ ; only few are reflected from thence and come out through the nearer surface between  $a$  and  $y$ . Now such rays as emerge, or come out of the drop, between  $a$  and  $y$ , will be ineffectual, unless they are parallel to one another, as  $rv$  and  $qt$  are; because such rays as come out diverging from one another, will be so far asunder when they come to the eye, that all of them cannot enter the pupil; and the very few that can enter it will not be sufficient to excite any sensation. But even rays, which are parallel, as  $rv, qt$ , will not be effectual, unless there are several of them contiguous or very near to one another. The two rays  $rv$  and  $qt$  alone will not be perceived, though both of them enter the eye; for so very few rays are not sufficient to excite a sensation.

When rays of light come out of a drop of rain after one reflection, those will be effectual which are reflected from the same point, and which entered the drop near to one another.

ANY rays, as  $sb$  and  $cd$ , (No. 44.) when they have passed out of the air into a drop of water, will be refracted towards the perpendiculars  $bl, dl$ ; and as the ray  $sb$  falls farther from the axis  $av$  than the ray  $cd$ ,  $sb$  will be more refracted than  $cd$ ; so that these rays, though parallel to one another at their incidence, may describe the lines  $be$  and  $de$  after refraction, and be both of them reflected from one and the same point  $e$ . Now all rays which are thus reflected from one and the same point, when they have described the lines  $ef, eg$ , and after reflection emerge at  $f$  and  $g$ , will be so refracted, when they pass out of the drop into the air, as to describe the lines  $fb, gi$ , parallel to one another. If these rays were to return from  $e$  in the lines  $eb, ed$ , and were to emerge at  $b$  and  $d$ , they would be refracted into the lines of their incidence  $bs, dc$ . But if these rays, instead of being returned in the lines  $eb, ed$ , are reflected from the same point  $e$  in the lines  $eg, ef$ , the lines of reflection  $eg$  and  $ef$  will be inclined both to one another and to the surface of the drop: just as much as the lines  $eb$  and  $ed$  are. First  $eb$  and  $eg$  make just the same angle with the surface of the drop: for the angle  $bex$  which  $eb$  makes with the surface of the drop, is the complement of incidence; and the angle  $gey$ , which  $eg$  makes with the surface, is the complement of reflection; and these two are equal to one another. In the same manner we might prove that  $ed$  and  $ef$  make equal angles with the surface of the drop. Secondly, the angle  $bed$  is equal to the angle  $seg$ , or the reflected rays  $eg, ef$ , and the incident rays  $be, de$ , are equally inclined to each other. For the angle of incidence  $bel$  is equal to the angle of reflection  $gel$ , and the angle of incidence  $dcl$  is equal to the angle of reflection

$fel$ ; consequently the difference between the angles of incidence is equal to the difference between the angles of reflection, or  $bel-dcl=gel-fel$ , or  $bed=gef$ . Since therefore either the lines  $eg, ef$ , or the lines  $eb, ed$ , are equally inclined both to one another and to the surface of the drop; the rays will be refracted in the same manner, whether they were to return in the lines  $eb, ed$ , or are reflected in the lines  $eg, ef$ . But if they were to return in the lines  $eb, ed$ , the refraction, when they emerge at  $b$  and  $d$ , would make them parallel. Therefore, if they are reflected from one and the same point  $e$  in the lines  $eg, ef$ , the refraction, when they emerge at  $g$  and  $f$ , will likewise make them parallel.

But though such rays, as are reflected from the same point in the hinder part of a drop of rain, are parallel to one another, when they emerge, and so have one condition that is requisite towards making them effectual; yet there is another condition necessary; for rays, that are effectual, must be contiguous, as well as parallel. And though rays, which enter the drop in different places, may be parallel when they emerge, those only will be contiguous which enter it nearly at the same place.

Let  $xy$ , (No. 43) be a drop of rain,  $ag$  the axis or diameter of the drop, and  $sa$  a ray of light that comes from the sun and enters the drop at the point  $a$ . This ray  $sa$ , because it is perpendicular to both the surfaces, will pass straight through the drop in the line  $agb$  without being refracted; but any collateral rays that fall about  $sb$ , as they pass through the drop, will be made to converge to their axis, and passing out at  $n$  will meet the axis at  $b$ : rays which fall farther from the axis than  $sb$ , such as those which fall about  $sc$ , will likewise be made to converge; but then their focus will be nearer to the drop than  $b$ . Suppose therefore  $i$  to be the focus to which the rays that fall about  $sc$  will converge, any ray  $sc$ , when it has described the line  $co$  within the drop, and is tending to the focus  $i$ , will pass out of the drop at the point  $o$ . The rays that fall upon the drop about  $sd$ , more remote still from the axis, will converge to a focus still nearer than  $i$ , as suppose at  $k$ . These rays therefore go out of the drop at  $p$ . The rays, that fall still more remote from the axis, as  $se$ , will converge to a focus nearer than  $k$ , as suppose at  $l$ ; and the ray  $se$ , when it has described the line  $eo$  within the drop, and is tending to  $l$ , will pass out at the point  $o$ . The rays, that fall still more remote from the axis, will converge to a focus still nearer. Thus the ray  $sf$  will after refraction converge to a focus at  $m$ , which is nearer than  $l$ ; and having described the line  $fn$  within the drop, it will pass out at the point  $n$ . Now here we may observe, that as any rays  $sb$  or  $sc$ , fall farther above the axis  $sa$ , the points  $n$ , or  $o$ , where they pass out behind the drop, will be farther above  $g$ ; or that, as the incident ray rises from the axis  $sa$ , the arc  $gno$  increases, till we come to some ray  $sd$ , which passes out of the drop at  $p$ ; and this is the highest point where any ray that falls upon the quadrant or quarter  $ax$  can pass out: for any rays  $se$ , or  $sf$ , that fall higher than  $sd$ , will not pass out in any point above  $p$ , but at the points  $o$ , or  $n$ , which are below it. Consequently, though the arc  $gnop$  increases, whilst the distance of the incident ray from the axis  $sa$  increased; till we come to the ray  $sd$ ; yet afterwards, the higher the ray

ray falls above the axis  $sa$ , this arc  $png$  will decrease.

We have hitherto spoken of the points on the hinder part of the drop, where the rays pass out of it; but this was for the sake of determining the points from whence those rays are reflected, which do not pass out behind the drop. For, in explaining the rain-bow, we have no farther reason to consider those rays which go through the drop; since they can never come to the eye of a spectator placed any where in the lines  $rv$  or  $qt$  with his face towards the drop. Now, as there are many rays which pass out of the drop between  $g$  and  $p$ , so some few rays will be reflected from thence; and consequently the several points between  $g$  and  $p$ , which are the points where some of the rays pass out of the drop, are likewise the points of reflection for the rest which do not pass out. Therefore, in respect of those rays which are reflected, we may call  $gp$  the arc of reflection; and may say, that this arc of reflection increases, as the distance of the incident ray from the axis  $sa$  increases, till we come to the ray  $sd$ ; the arc of reflection is  $gn$  for the ray  $sb$ , it is  $go$  for the ray  $sc$ , and  $gp$  for the ray  $sd$ . But after this, as the distance of the incident ray from the axis  $sa$  increases, the arc of reflection decreases; for  $og$  less than  $pg$  is the arc of reflection for the ray  $se$ , and  $ng$  is the arc of reflection for the ray  $sf$ .

From hence it is obvious, that some one ray, which falls above  $sd$ , may be reflected from the same point with some other ray which falls below  $sd$ . Thus, for instance, the ray  $sb$  will be reflected from the point  $n$ , and the ray  $sf$  will be reflected from the same point; and consequently, when the reflected rays  $nr$ ,  $nq$ , are refracted as they pass out of the drop at  $r$  and  $q$ , they will be parallel, by what has been shewn in the former part of this proposition. But since the intermediate rays, which enter the drop between  $sf$  and  $sb$ , are not reflected from the same point  $n$ , these two rays alone will be parallel to one another when they come out of the drop, and the intermediate rays will not be parallel to them. And consequently these rays  $rv$ ,  $qt$ , though they are parallel after they emerge at  $r$  and  $q$ , will not be contiguous, and for that reason will not be effectual; the ray  $sd$  is reflected from  $p$ , which has been shewn to be the limit of the arc of reflection; such rays, as fall just above  $sd$ , and just below  $sd$ , will be reflected from nearly the same point  $p$ , as appears from what has been already shewn. These rays therefore will be parallel; because they are reflected from the same point  $p$ ; and they will likewise be contiguous, because they all of them enter the drop at one and the same place very near to  $d$ . Consequently, such rays as enter the drop at  $d$ , and are reflected from  $p$  the limit of the arc of reflection, will be effectual; since, when they emerge at the fore part of the drop between  $a$  and  $y$ , they will be both parallel and contiguous.

If we can make out hereafter that the rain bow is produced by the rays of the sun which are thus reflected from drops of rain as they fall whilst the sun shines upon them, this proposition may serve to shew us, that this appearance is not produced by any rays that fall upon any part and are reflected from any part of those drops: since this appearance cannot be produced by any rays but those which are effectual; and effectual rays must al-

ways enter each drop at one certain place in the fore-part of it, and must likewise be reflected from one certain place in the hinder surface.

*When rays that are effectual-emerge from a drop of rain after one reflection and two refractions, those which are most refrangible will, at their emergence, make a less angle with the incident rays than those do which are least refrangible; and by this means the rays of different colours will be separated from one another,*

Let  $fb$  and  $gi$ , (No. 44.) be effectual violet rays emerging from the drop at  $fg$ ; and  $fn$ ,  $gp$ , effectual red rays emerging from the same drop at the same place. Now, though all the violet rays are parallel to one another, because they are supposed effectual; and though all the red rays are likewise parallel to one another for the same reason; yet the violet rays will not be parallel to the red rays. These rays, as they have different colours, and different degrees of refrangibility, will diverge from one another; any violet ray  $gi$ , which emerges at  $g$ , will diverge from any red ray  $gp$ , which emerges at the same place. Now, both the violet ray  $gi$ , and the red ray  $gp$ , as they pass out of the drop of water into the air, will be refracted from the perpendicular  $lo$ . But the violet ray is more refrangible than the red one, and for that reason  $gi$ , or the refracted violet ray, will make a greater angle with the perpendicular than  $gp$  the refracted red ray; or the angle  $igo$  will be greater than the angle  $ppo$ . Suppose the incident ray  $sb$  to be continued in the direction  $sk$ , and the violet ray  $ig$  to be continued backward in the direction  $ik$ , till it meets the incident ray at  $k$ . Suppose likewise the red ray  $pg$  to be continued backwards in the same manner, till it meets the incident ray at  $w$ . The angle  $ikk$  is that which the violet ray, or most refrangible ray at its emergence, makes with the incident ray; and the angle  $pwv$  is that which the red ray, or least refrangible ray at its emergence, makes with the incident ray. The angle  $iks$  is less than the angle  $pwv$ . For, in the triangle  $gwk$ ,  $gws$  or  $pwv$  is the external angle at the base, and  $gkw$  or  $iks$  is one of the internal opposite angles; and either internal opposite angle is less than the external angle at the base. Euc. b. I. prop. 16. What has been shewn to be true of the rays  $gi$  and  $gp$  might be shewn in the same manner of the rays  $fb$  and  $fn$ , or of any other rays that emerge respectively parallel to  $gi$  and  $gp$ . But all the effectual violet rays are parallel to  $gi$ , and all the effectual red rays are parallel to  $gp$ . Therefore the effectual violet rays at their emergence make a less angle with the incident ones than the effectual red ones. And for the same reason, in all the other sorts of rays, those which are most refrangible, at their emergence from a drop of rain after one reflection, will make a less angle with the incident rays, than those do which are less refrangible.

Or otherwise: When the rays  $gi$  and  $gp$  emerge at the same point  $g$ , as they both come out of water into air, and consequently are refracted from a perpendicular, instead of going straight forwards in the line  $eg$  continued, they will both be turned round upon the point  $g$  from the perpendicular  $go$ . Now it is easy to conceive, that either of these lines might be turned in this manner upon the point

$g$  as upon a centre, till they became parallel to  $sb$  the incident ray. But if either of these lines or rays were refracted so much from  $g$  as to become parallel to  $sb$ , the ray so much refracted would, after emersion, make no angle with  $sk$ , because it would be parallel to it. And consequently that ray which is most turned round upon the point  $g$ , or that ray which is most refrangible, will after emersion be nearest parallel to the incident ray, or will make the least angle with it. The same may be proved of all other rays emerging parallel to  $gi$  and  $gp$  respectively, or of all effectual rays; those, which are most refrangible, will after emersion make a less angle with the incident rays, than those do which are least refrangible.

But since the effectual rays of different colours make different angles with  $sk$  at their emersion, they will be separated from one another: so that if the eye was placed in the beam  $fghi$ , it would receive only rays of one colour from the drop  $xagy$ ; and if it was placed in the beam  $gnp$ , it would receive only rays of some other colour.

The angle  $rap$ , which the least refrangible or red rays make with the incident ones, when they emerge so as to be effectual, is found by calculation to be 42 degrees 2 minutes. And the angle  $ski$ , which the most refrangible rays make with the incident ones, when they emerge so as to be effectual, is found to be 40 degrees 17 minutes. The rays, which have the intermediate degrees of refrangibility, make with the incident ones intermediate angles between 42 degrees 2 minutes and 40 degrees 17 minutes.

*If a line is supposed to be drawn from the centre of the sun through the eye of the spectator, the angle which any effectual ray, after two refractions and one reflection, makes with the incident ray, will be equal to the angle which it makes with that line.*

Let the eye of the spectator be at  $i$ , (No. 44.) and let  $qt$  be the line supposed to be drawn from the centre of the sun through the eye of the spectator; the angle  $git$ , which any effectual ray makes with this line, will be equal to the angle  $iks$ , which the same ray makes with the incident ray  $sb$  or  $sk$ . If  $sb$  is a ray coming from the centre of the sun, then since  $qt$  is supposed to be drawn from the same point, these two lines, upon account of the remoteness of the point from whence they are drawn, may be looked upon as parallel to one another. But the right line  $ki$  crossing these two parallel lines will make the alternate angles equal. Euc. b. I. prop. 29. Therefore  $kit$  or  $git$  is equal to  $ski$ .

*When the sun shines upon the drops of rain as they are falling; the rays that come from those drops to the eye of a spectator, after one reflection and two refractions, produce the primary rainbow.*

If the sun shines upon the rain as it falls, there are commonly seen two bows, as AFB, CHD, (No. 46.) or if the cloud and rain does not reach over that whole side of the sky where the bows appear, then only a part of one or of both bows is seen in that place where the rain falls. Of these two bows, the innermost AFB is the more vivid of the two, and this is called the primary bow. The outer part TFY of the primary bow is red, the inner part

VEX is violet; the intermediate parts, reckoning from the red to the violet, are orange, yellow, green, blue, and indigo. Suppose the spectator's eye to be at O, and let LOP be an imaginary line drawn from the centre of the sun through the eye of the spectator: If a beam of light S coming from the sun falls upon any drop F; and the rays that emerge at F in the line FO, so as to be effectual, make an angle FOP of 42 degrees 2 minutes with the line LP; then these effectual rays make an angle of 42 degrees 2 minutes with the incident rays, by the preceding proposition, and consequently these rays will be red, so that the drop F will appear red. All the other rays, which emerge at F, and would be effectual if they fell upon the eye, are refracted more than the red ones, and consequently will pass above the eye. If a beam of light S falls upon the drop E; and the rays that emerge at E in the line EO, so as to be effectual, make an angle EOP of 40 degrees 17 minutes with the line LP; then these effectual rays make likewise an angle of 40 degrees 17 minutes with the incident rays, and the drop E will appear of a violet colour. All the other rays, which emerge at E, and would be effectual if they came to the eye, are refracted less than the violet ones, and therefore pass below the eye. The intermediate drops between F and E will for the same reasons be of the intermediate colours.

Thus we have shewn why a set of drops from F to E, as they are falling, should appear of the primary colours, red, orange, yellow, green, blue, indigo, and violet. It is not necessary that the several drops, which produce these colours, should all of them fall at exactly the same distance from the eye. The angle FOP, for instance, is the same whether the distance of the drop from the eye is OF, or whether it is in any other part of the line OF something nearer to the eye. And whilft the angle FOP is the same, the angle made by the emerging and incident rays, and consequently the colour of the drop, will be the same. This is equally true of any other drop. So that although in the figure the drops F and E are represented as falling perpendicularly one under the other, yet this is not necessary in order to produce the bow.

But the coloured line FE, which we have already accounted for, is only the breadth of the bow. It still remains to be shewn, why not only the drop F should appear red, but why all the other drops quite from A to B in the arc ATFYB should appear of the same colour. Now it is evident, that where-ever a drop of rain is placed, if the angle, which the effectual rays make with the line LP is equal to the angle FOP, that is, if the angle which the effectual rays make with the incident rays is 42 degrees 2 minutes, any of those drops will be red, for the same reason that the drop F is of this colour.

If FOP was to turn round upon the line OP, so that one end of this line should always be at the eye, and the other be at P opposite to the sun; such a motion of this figure would be like that of a pair of compasses turning round upon one of the legs OP with the opening FOP. In this revolution the drop F would describe a circle, P would be the centre, and ATFYB would be an arc in this circle. Now since, in this motion of the line and drop OF, the angle made by FO with OP, that is, the angle FOP, continues the same; if the sun was to shine upon this drop as it revolves, the effectual rays would make the same

angle

angle with the incident rays, in whatever part of the arc ATFYB the drop was to be. Therefore, whether the drop is at A, or at T, or at Y, or at B, or where-ever else it is in this whole arc, it would appear red, as it does at F. The drops of rain, as they fall, are not indeed turned round in this manner: but then, as innumerable of them are falling at once in right lines from the cloud, whilst one drop is at F, there will be others at Y, at T, at B, at A, and in every other part of the arc ATFYB: and all these drops will be red for the same reason that the drop F would have been red, if it had been in the same place. Therefore, when the sun shines upon the rain as it falls, there will be a red arc ATFYB opposite to the sun. In the same manner, because the drop E is violet, we might prove that any other drop, which, whilst it is falling, is in any part of the arc AVEXB, will be violet, and consequently, at the same time that the red arc ATFYB appears, there will likewise be a violet arc AVEXB below or within it. FE is the distance between these two coloured arcs; and from what has been said it follows, that the intermediate space between these two arcs will be filled up with arcs of the intermediate colours, orange, yellow, blue, green, and indigo. All these coloured arcs together make up the primary rainbow.

*The primary rainbow is never a greater arc than a semicircle.*

Since the line LOP is drawn from the sun through the eye of the spectator, and since P (No. 46.) is the centre of the rainbow; it follows, that the centre of the rainbow is always opposite to the sun. The angle FOP is an angle of 42 degrees 2 minutes, as was observed, or F the highest part of the bow is 42 degrees 2 minutes from P the centre of it. If the sun is more than 42 degrees 2 minutes high, P the centre of the rainbow, which is opposite to the sun, will be more than 42 degrees 2 minutes below the horizon; and consequently F the top of the bow, which is only 42 degrees 2 minutes from P, will be below the horizon; that is, when the sun is more than 42 degrees 2 minutes high, no primary rainbow will be seen. If the sun is something less than 42 degrees 2 minutes high, then P will be something less than 42 degrees 2 minutes below the horizon; and consequently F, which is only 42 degrees 2 minutes from P, will be just above the horizon; that is, a small part of the bow at this height of the sun will appear close to the ground opposite to the sun. If the sun is 20 degrees high, then P will be 20 degrees below the horizon; and F the top of the bow, being 42 degrees 2 minutes from P, will be 22 degrees 2 minutes above the horizon; therefore, at this height of the sun, the bow will be an arc of a circle whose centre is below the horizon; and consequently that arc of the circle, which is above the horizon, or the bow, will be less than a semicircle. If the sun is in the horizon, then P, the centre of the bow, will be in the opposite part of the horizon; F, the top of the bow, will be 42 degrees 2 minutes above the horizon; and the bow itself, because the horizon passes thro' the centre of it, will be a semicircle. More than a semicircle can never appear; because if the bow was more than semicircle, P the centre of it must be above the horizon; but P is always opposite to the sun, therefore P cannot be above the horizon, unless the sun is below it; and when the sun is set, or is below the horizon, it cannot shine upon the drops of rain, as they fall; and consequently, when the sun is below the horizon, no bow at all can be seen.

*When the rays of the sun fall upon a drop of rain, some of them, after two reflections and two refractions, may come to the eye of a spectator, who has his back towards the sun and his face towards the drop.*

If *hgw*, (No. 45.) is a drop of rain, and parallel rays coming from the sun, as *zv*, *yw*, fall upon the lower part of it, they will be refracted towards the perpendiculars *vl*, *wl*, as they enter into it, and will describe some such lines as *vh*, *wi*. At *b* and *i* great part of these rays will pass out of the drop; but some of them will be reflected from thence in the lines *hf*, *ig*. At *f* and *g* again, great part of the rays, that were reflected thither, will pass out of the drop. But these rays will not come to the eye of a spectator at *o*. However, here again all the rays will not pass out; but some few will be reflected from *f* and *g*, in some such lines as *fd*, *gb*; and these, when they emerge out of the drop of water into the air at *b* and *d*, will be refracted from the perpendiculars, and, describing the lines *dt*, *bo*, may come to the eye of a spectator who has his back towards the sun and his face towards the drop.

*Those rays, which are parallel to one another after they have been once refracted and once reflected in a drop of rain, will be effectual when they emerge after two refractions and two reflections.*

No rays can be effectual, unless they are contiguous, and parallel. From what was said, it appears, that when rays come out of a drop of rain contiguous to one another, either after one or after two reflections, they must enter the drop nearly at one and the same place. And if such rays as are contiguous are parallel after the first reflection, they will emerge parallel, and therefore will be effectual. Let *zv* and *yw* be contiguous rays which come from the sun, and are parallel to one another when they fall upon the lower part of the drop *hgw*, (No. 45.) suppose these rays to be refracted at *v* and *w*, and to be reflected at *b* and *i*; if they are parallel to one another, as *hf*, *gi*, after this first reflection, then, after they are reflected a second time from *f* and *g*, and refracted a second time as they emerge at *d* and *b*, they will go out of the drop parallel to one another in the lines *dt* and *bo*, and will therefore be effectual.

The rays *zv*, *yw*, are refracted towards the perpendiculars *vl*, *wl*, when they enter the drop, and will be made to converge. As these rays are very oblique, their focus will not be far from the surface *vw*. If this focus is at *k*, the rays, after they have passed the focus, will diverge from thence in the directions *kb*, *ki*; and if *ki* is the principal focal distance of the concave reflecting surface *bi*, the reflected rays *hf*, *ig*, will be parallel. These rays *hf*, *ig*, are reflected again from the concave surface *fg*, and will meet in a focus at *e*, so that *ge* will be the principal focal distance of this reflecting surface *fg*. And because *ki* and *fg* are parts of the same sphere, the principal focal distances *ge* and *ki* will be equal to one another. When the rays have passed the focus *e*, they will diverge from thence in the lines *ed*, *eb*: and we are to shew, that, when they emerge at *d* and *b*, and are refracted there, they will become parallel.

Now if the rays *vk*, *wk*, when they have met at *k*, were to be turned back again in the directions *kv*, *kw*, and were to emerge at *v* and *w*, they would be refracted into the lines of their incidence *zv*, *yw*, and therefore would be parallel. But since *ge* is equal to *ki*, as has already been shewn, the rays

rays  $ed, eb$ , that diverge from  $e$ , fall in the same manner upon the drop at  $d$  and  $b$ , as the rays  $kv, kw$ , would fall upon it at  $v$  and  $w$ ; and  $ed, eb$ , are just as much inclined to the refracting surface  $db$ , as  $kv, kw$ , would be to the surface  $vw$ . From hence it follows, that the rays  $ed, eb$ , emerging at  $d$  and  $b$ , will be refracted in the same manner, and will have the same direction in respect of one another, as  $kv, kw$ , would have. But  $kv$  and  $kw$  would be parallel after refraction. Therefore  $ed$  and  $eb$  will emerge in lines  $dp, bo$ , so as to be parallel to one another, and consequently so as to be effectual.

*When rays that are effectual emerge from a drop of rain after two reflections and two refractions, those which are most refrangible will at their emergence make a greater angle with the incident rays than these do which are least refrangible; and by this means the rays of different colours will be separated from one another.*

If rays of different colours, which are differently refrangible, emerge at any point  $b$ , (No. 45.) these rays will not be all of them equally refracted from the perpendicular. Thus, if  $bo$  is a red ray, which is of all others the least refrangible, and  $bm$  is a violet ray, which is of all others the most refrangible; when these two rays emerge at  $b$ , the violet ray will be refracted more from the perpendicular  $bx$  than the red ray, and the refracted angle  $xbm$  will be greater than the refracted angle  $xbo$ . From hence it follows, that these two rays, after emergence, will diverge from one another. In like manner, the rays that emerge at  $d$  will diverge from one another; a red ray will emerge in the line  $dp$ , a violet ray in the line  $dt$ . So that though all the effectual red rays of the beam  $bdmt$  are parallel to one another, and all the effectual red rays of the beam  $bdop$  are likewise parallel to one another, yet the violet rays will not be parallel to the red ones, but the violet beam will diverge from the red beam. Thus the rays of different colours will be separated from one another.

This will appear farther, if we consider what the proposition affirms, That any violet or most refrangible ray will make a greater angle with the incident rays, than any red or least refrangible ray makes with the same incident rays. Thus if  $yw$  is an incident ray,  $bm$  a violet ray emerging from the point  $b$ , and  $bo$  a red ray emerging from the same point; the angle which the violet ray makes with the incident one is  $ym$ , and that which the red ray makes with it is  $yo$ . Now  $ym$  is a greater angle than  $yo$ . For in the triangle  $brs$  the internal angle  $brs$  is less than  $bry$  the external angle at the base. Euc. b. I. prop. 16. But  $ym$  is the complement of  $brs$  or of  $bry$  to two right ones, and  $yo$  is the complement of  $bry$  to two right ones. Therefore, since  $bry$  is less than  $bry$ , the complement of  $bry$  to two right angles will be greater than the complement of  $bry$  to two right angles; or  $ym$  will be greater than  $yo$ .

Or otherwise: Both the rays  $bo$  and  $bm$ , when they are refracted in passing out of the drop at  $b$ , are turned round upon the point  $b$  from the perpendicular  $bx$ . Now either of these lines  $bo$  or  $bm$  might be turned round in this manner, till it made a right angle with  $yw$ . Consequently, that ray which is most turned round upon  $b$ , or which is most refracted, will make an angle with  $yw$  that will be nearer to a right one than that ray makes with it which is least turned round upon  $b$ , or which is least refracted. Therefore

that ray which is most refracted will make a greater angle with the incident ray than that which is least refracted.

But since the emerging rays, as they are differently refrangible, make different angles with the same incident ray  $yw$ , the refraction which they suffer at emergence will separate them from one another.

The angle  $ym$ , which the most refrangible or violet rays make with the incident ones, is found by calculation to be 54 degrees 7 minutes; and the angle  $yo$ , which the least refrangible or red rays make with the incident ones, is found to be 50 degrees 57 minutes: the angles, which the rays of the intermediate colours, indigo, blue, green, yellow, and orange, make with the incident rays, are intermediate angles between 54 degrees 7 minutes and 50 degrees 57 minutes.

*If a line is supposed to be drawn from the centre of the sun through the eye of the spectator; the angle, which, after two refractions and two reflections, any effectual ray makes with the incident ray, will be equal to the angle which it makes with that line.*

If  $yw$ , (No 45.) is an incident ray,  $bo$  an effectual ray, and  $qn$  a line drawn from the centre of the sun through  $o$  the eye of the spectator; the angle  $yo$ , which the effectual ray makes with the incident ray, is equal to  $son$  the angle which the same effectual ray makes with the line  $qn$ . For  $yw$  and  $qn$ , considered as drawn from the centre of the sun, are parallel;  $bo$  crosses them, and consequently makes the alternate angles  $yo$ ,  $son$ , equal to one another. Euc. b. I. prop. 29.

*When the sun shines upon the drops of rain as they are falling; the rays that come from those drops to the eye of a spectator, after two reflections and two refractions, produce the secondary rainbow.*

The secondary rainbow is the outermost CHD, No. 46. When the sun shines upon a drop of rain  $H$ ; and the rays  $HO$ , which emerge at  $H$  so as to be effectual, make an angle HOP of 54 degrees 7 minutes with LOP a line drawn from the sun through the eye of the spectator; the same effectual rays will make likewise an angle of 54 degrees 7 minutes with the incident rays  $S$ , and the rays which emerge at this angle are violet ones, by what was observed above. Therefore, if the spectator's eye is at  $O$ , none but violet rays will enter it: for as all the other rays make a less angle with OP, they will fall above the spectator's eye. In like manner, if the effectual rays that emerge from the drop  $G$  make an angle of 50 degrees 57 minutes with the line OP, they will likewise make the same angle with the incident rays  $S$ ; and consequently, from the drop  $G$  to the spectator's eye at  $O$ , no rays will come but red ones; for all the other rays, making a greater angle with the line OP, will fall below the eye at  $O$ . For the same reason, the rays emerging from the intermediate drops between  $H$  and  $G$ , and coming to the spectator's eye at  $O$ , will emerge at intermediate angles, and therefore will have the intermediate colours. Thus, if there are seven drops from  $H$  to  $G$  inclusively, their colours will be violet, indigo, blue, green, yellow, orange and red. This coloured line is the breadth of the secondary rainbow,

Now, if HOP was to turn round upon the line OP, like a pair of compasses upon one of the legs OP with the opening HOP, it is plain from the supposition, that, in such a revolution of the drop  $H$ , the angle HOP would be the same,

same, and consequently the emerging rays would make the same angle with the incident ones. But in such a revolution the drop would describe a circle of which P would be the centre and CNHRD an arc. Consequently, since, when the drop is at N, or at R, or any where else in that arc, the emerging rays make the same angle with the incident ones as when the drop is at H, the colour of the drop will be the same to an eye placed at O, whether the drop is at N, or at H, or at R, or any where else in that arc. Now, though the drop does not thus turn round as it falls, and does not pass through the several parts of this arc, yet, since there are drops of rain falling every where at the same time, when one drop is at H, there will be another at R, another at N, and others in all parts of the arc; and these drops will all of them be violet-coloured, for the same reason that the drop H would have been of this colour if it had been in any of those places. In like manner, as the drop G is red when it is at G, it would likewise be red in any part of the arc CWGQD; and so will any other drop, when, as it is falling, it comes to any part of that arc. Thus as the sun shines upon the rain, whilst it falls, there will be two arcs produced, a violet coloured one CNHRD, and a red one CWGQD; and for the same reasons the intermediate space between these two arcs will be filled up with arcs of the intermediate colours. All these arcs together make up the secondary rainbow.

*The colours of the secondary rainbow are fainter than those of the primary rainbow; and are ranged in the contrary order.*

The primary rainbow is produced by such rays as have been only once reflected; the secondary rainbow is produced by such rays as have been twice reflected. But at every reflection some rays pass out of the drop of rain without being reflected; so that the oftener the rays are reflected, the fewer of them are left. Therefore the colours of the secondary bow are produced by fewer rays, and consequent-

ly will be fainter, than the colours of the primary bow.

In the primary bow, reckoning from the outside of it, the colours are ranged in this order; red, orange, yellow, green, blue, indigo, violet. In the secondary bow, reckoning from the outside, the colours are violet, indigo, blue, green, yellow, orange, red. So that the red, which is the outermost or highest colour in the primary bow, is the innermost or lowest colour in the secondary one.

Now the violet rays, when they emerge so as to be effectual after one reflection, make a less angle with the incident rays than the red ones; consequently the violet rays make a less angle with the lines OP, (No. 46.) than the red ones. But in the primary rainbow the rays are only once reflected, and the angle which the effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops or violet arc in the primary bow will be nearer to the centre of the bow, than the red drops or red arc; that is, the innermost colour in the primary bow will be violet, and the outermost colour will be red. And, for the same reason, through the whole primary bow, every colour will be nearer to the centre P, as the rays of that colour are more refrangible.

But the violet rays, when they emerge so as to be effectual after two reflections, make a greater angle with the incident rays than the red ones; consequently the violet rays will make a greater angle with the line OP, than the red ones. But in the secondary rainbow the rays are twice reflected, and the angle which effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops or violet arc in the secondary bow will be farther from the centre of the bow than the red drops or red arc; that is, the outermost colour in the secondary bow will be violet, and the innermost colour will be red. And, for the same reason, through the whole secondary bow, every colour will be farther from the centre P, as the rays of that colour are more refrangible.

## O R A

OPTIMATES, in Roman antiquity, were, according to Tully, the best citizens, who desired their actions might be approved of by the better sort; and the populares, those who, out of a thirst of vain-glory, did not consider so much what was right, as what would please the populace.

OPUNTIA, in botany. See CACTUS.

OR, in heraldry, denotes yellow, or gold colour. See COLOUR and METAL.

In the coats of noblemen, it is blazoned topaz; and in those of sovereign princes, sol.

It is represented in engraving by small points or dots, scattered all over the field or bearing. See Pl. 134. fig. 5.

ORACLE, among the heathens, was the answer which the gods were supposed to give to those who consulted them upon any affair of importance; it is also used for the god who it was thought gave the answer, and the place where it was given.

The credit of oracles was so great, that in all doubts and disputes their determinations were held sacred and inviolable: whence vast numbers flocked to them for advice about the management of their affairs; and no business of any consequence was undertaken, scarce any

## O R A

peace concluded, any war waged, or any new form of government instituted, without the advice and approbation of some oracle. The answers were usually given by the intervention of the priest or priestesses of the god who was consulted; and generally expressed in such dark and intermediate phrases, as might be easily wrestled to prove the truth of the oracle whatever was the event. It is not, therefore, to be wondered at, that the priests who delivered them were in the highest credit and esteem; and that they improved this reputation greatly to their advantage. They accordingly allowed no man to consult the gods, before he had offered costly sacrifices, and made rich presents to them. And to keep up the veneration for their oracles, and to prevent their being taken unprepared, they admitted persons to consult the gods only at certain stated times; and sometimes they were so cautious, that the greatest persons could obtain no answer at all. Thus Alexander himself was peremptorily denied by the pythia, or priestess of Apollo, till she was, by downright force, obliged to ascend the tripod; when, being unable to resist any longer, she cried out, *thou art invincible*; and these words were accepted instead of a farther oracle. See MYTHOLOGY.

ORACH,

ORACH, in botany. See *ATRIPLEX*.

ORAL, something delivered by word of mouth, without being committed to writing; in which sense we say, oral law, oral tradition, &c.

ORANGE-TREE, in botany. See *CITRUS*.

ORANGE, in geography, a city of Provence, in France, capital of the principality of Orange: it is situated on the east side of the river Rhone, seventeen miles north of Avignon: E. long. 4° 46', N. lat. 44° 10'.

ORATION, in rhetoric, a speech or harangue, composed according to the rules of oratory, and spoken in public.

Orations may be all reduced to three kinds, *viz.* the demonstrative, deliberative, and judicial. To the demonstrative kind belong panegyrics, genethliaca, epithalamia, congratulations, &c. To the deliberative kind belong persuasion, exhortation, &c. And to the judicial kind belong accusation, confutation, &c.

ORATORIO, in the Italian musick, a sort of sacred drama of dialogues; containing recitatives, duettos, trios, ritornellos, choruses, &c.

The subjects of these pieces are usually taken from the scriptures, or from the life of some saint, &c.

The musick for the oratorio should be in the finest taste, and best chosen strains. These oratorios are greatly used at Rome, in time of lent; and of late, in England.

ORATORY. See *RHETORIC*.

ORATORY, among the Romanists, a closet or like apartment near a bed-chamber, furnished with an altar, crucifix, &c. for private devotion.

ORB, in astronomy, &c. denotes an hollow globe or sphere.

ORBICULARIS, in anatomy. See *ANATOMY*, p. 306.

ORBIS, in ichthyology, a name given to two species of ostracion, nearly as broad as long, and covered with spines. See *OSTRACION*.

ORBIS MAGNUS, in astronomy, denotes the earth's orbit, in its annual revolution round the sun.

ORBIT, in astronomy, the path of a planet or comet, or the curve that it describes in its revolution round its central body: thus the earth's orbit is the curve which it describes in its annual course, and usually called the elliptic. See *ASTRONOMY*.

ORCADES, the *ORKNEY-ISLANDS*. See *ORKNEY*.

ORCHARD, a plantation of fruit-trees. See *GARDENING*.

ORCHESTRA, in the ancient theatres, a place in the form of a semi-circle, where the dancing was performed.

In the Greek theatres, the orchestra made part of the stage; but, among the Romans, it answered nearly to our pit; only that in it were disposed the seats for the senators, magistrates, vestals, and other persons of distinction.

ORCHIS, in botany, a genus of the gynandria diandria class. The nectarium is shaped like a horn behind the flower. There are 32 species, 12 of them natives of Britain. The root of the morio, or female fool-stones, has been celebrated as an aphrodisiac, but without any solid foundation.

ORDEAL, a form of trial, or of discovering innocence or guilt, formerly practised over almost all Europe, and which prevailed in England from the time of Edward the Confessor, till it was abolished by a declaration of Henry III. It was called *purgatio vulgaris*, or *judicium*; in

opposition to *bellum* or combat, the other form of purgation; and was of various kinds, as that of fire, that of red-hot-iron, that of water, that of judicial potage, that of hallowed cheefe, that of the green cross, and that of dice laid on relics covered with a woollen cloth. To each of which kinds particular masses were appointed.

In England, an offender, on being arraigned and pleading not guilty, had it in his choice to put himself upon God and his country; that is, upon the verdict of a jury; or upon God alone, on which account it was called the judgment of God, it being presumed that God would deliver the innocent. The more popular kinds of ordeal were those of red-hot iron and water; the first for freemen and people of fashion, and the last for peasants. That by fire, as practised here, was the person's walking bare-footed and blindfold over nine red-hot ploughshares; and if he escaped unhurt, he was acquitted; otherwise, condemned. That of water was of two kinds, *viz.* either with hot water, or cold: the former was where the person suspected put his arm or leg into scalding water, and brought it out unhurt; and the latter was when his body was not, contrary to the course of nature, borne up by the water.

ORDER, in architecture, is a system of the several members, ornaments, and proportions of columns and pilasters; or a regular arrangement of the projecting parts of a building, especially the column, so as to form one beautiful whole. See *ARCHITECTURE*.

ORDER is also used for a division or class of any thing: thus, the tribe of animals called birds is subdivided into six orders. See *NATURAL HISTORY*, and *BOTANY*.

Holy ORDERS, a character peculiar to ecclesiastics, whereby they are set apart for the ministry. See *ORDINATION*.

Military ORDERS, are companies of knights, instituted by kings and princes; either for defence of the faith, or to confer marks of honour, and make distinctions among their subjects.

Religious ORDERS, are congregations or societies of monastics, living under the same superior, in the same manner, and wearing the same habit.

ORDINAL, a book containing the order or manner of performing divine service.

ORDINANCE, or *ORDONNANCE*, a law, statute, or command of a sovereign or superior: thus the acts of parliament are sometimes termed ordinances of parliament.

ORDINARY, in civil law, is any judge invested with authority to take cognizance of causes in his own right, and not by deputation.

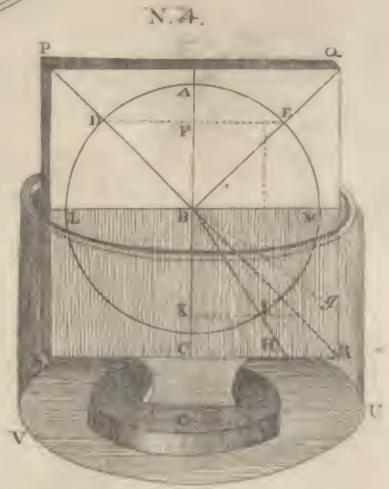
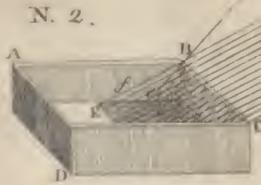
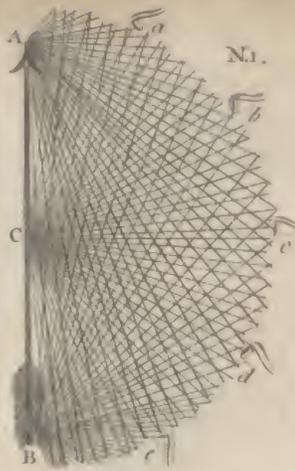
ORDINARY, or *honourable ORDINARY*, in heraldry, a denomination given to certain charges properly belonging to that art. The honourable ordinaries are ten in number; *viz.* the chief, pale, bend, fesse, bar, cross, saltier, chevron, bordure, and orle. For which see the articles *CHIEF*, *PALE*, &c.

ORDINATES. See *CONIC SECTIONS*.

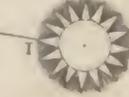
ORDINATION, the act of conferring holy orders, or of initiating a person into the priesthood by prayer and the laying on of hands.

ORDNANCE, a general name for all sorts of great guns used in war. See *GUNNERY*.

Office of *ORDNANCE*, an office kept within the tower of London, which superintends and disposes of all the arms, instruments, and utensils of war, both by sea and land,



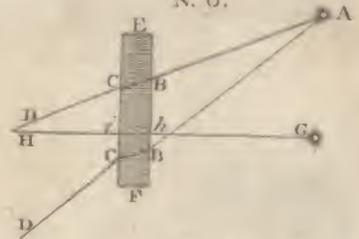
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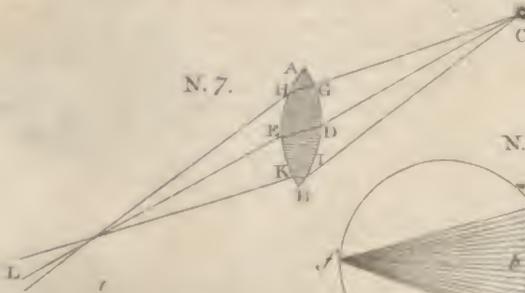
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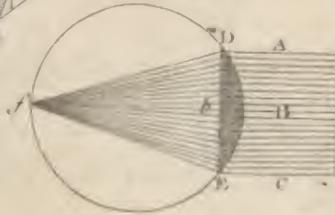
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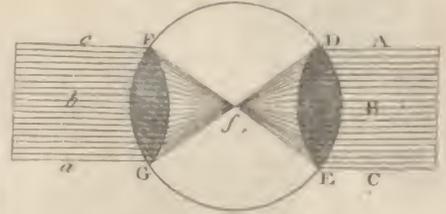
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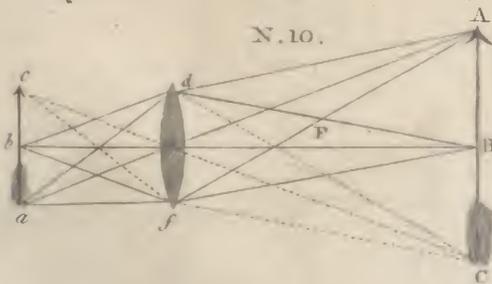
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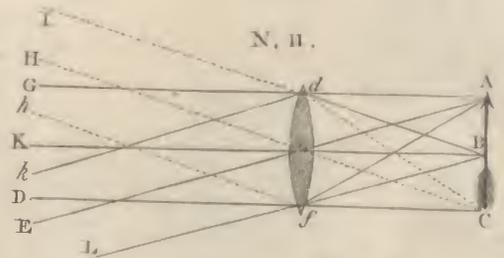
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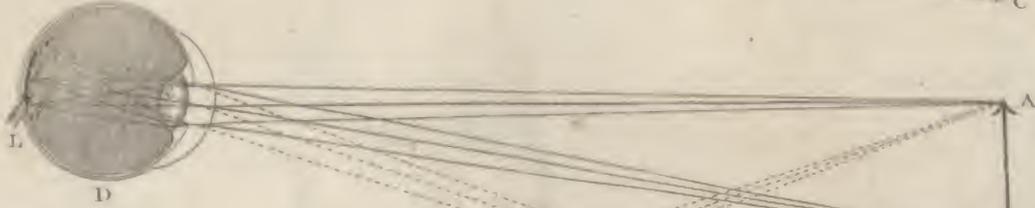
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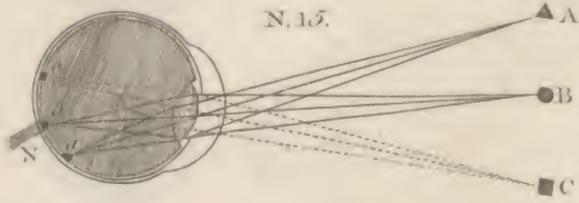
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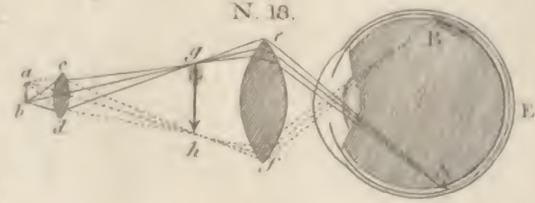
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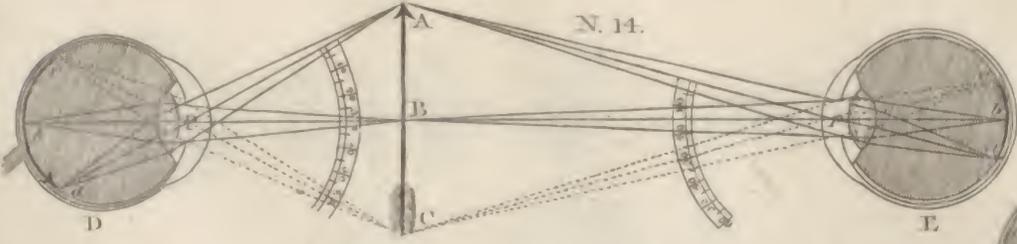
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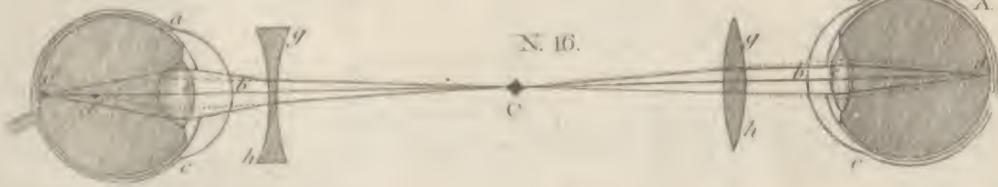
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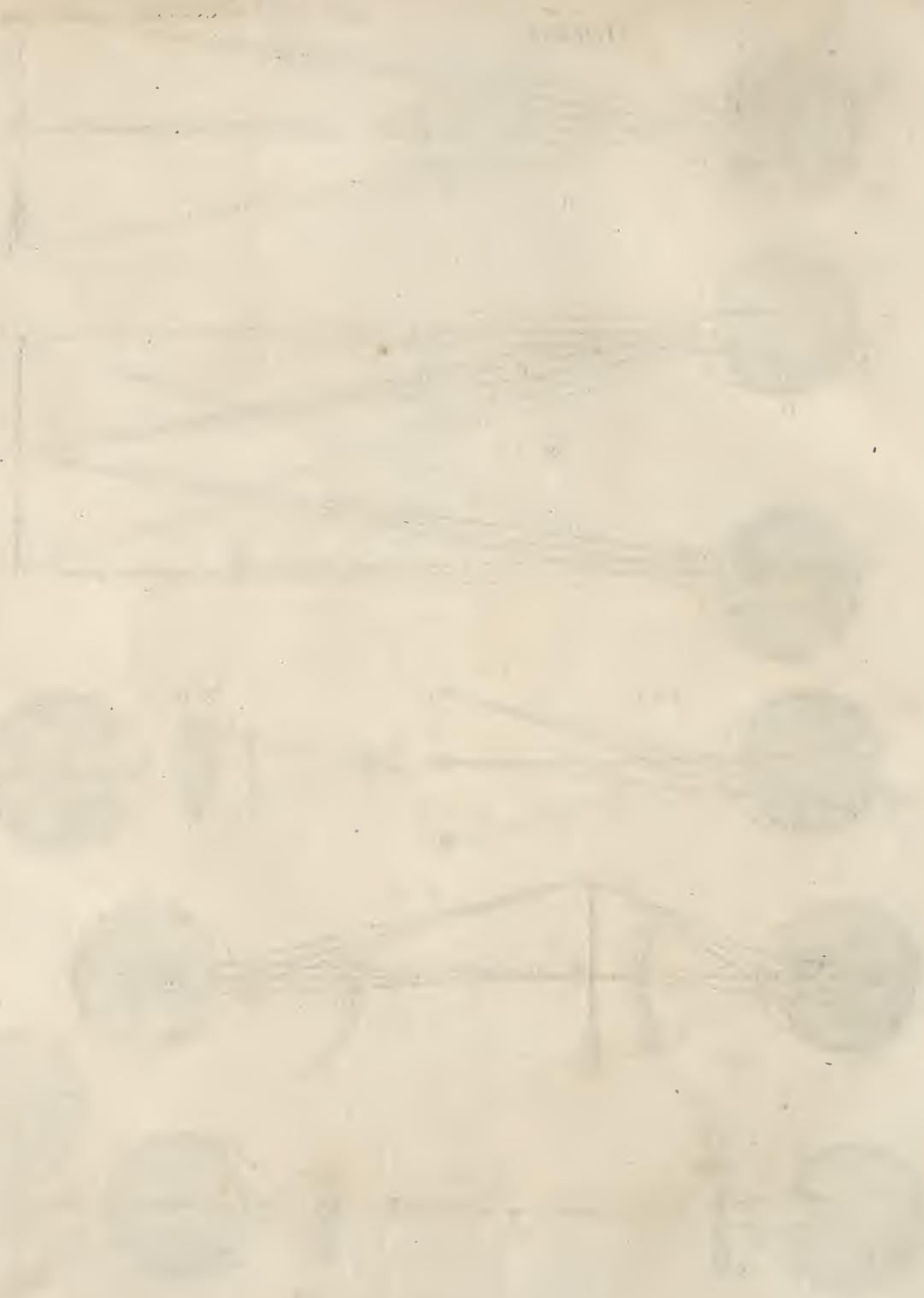


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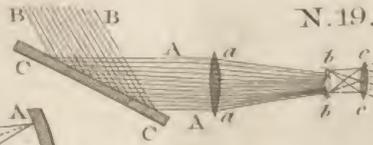
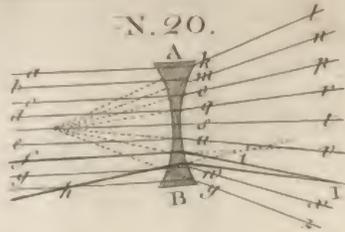
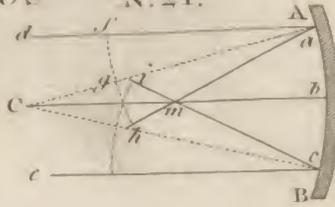


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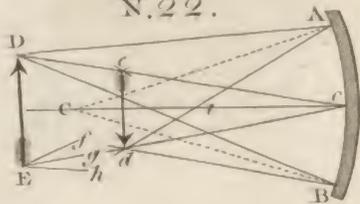




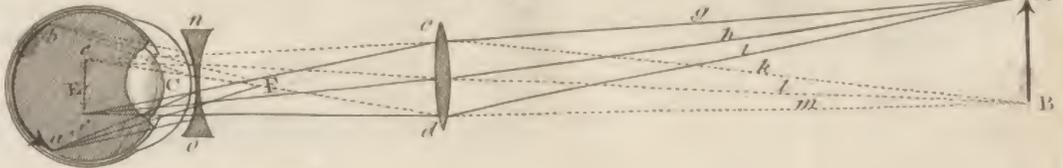
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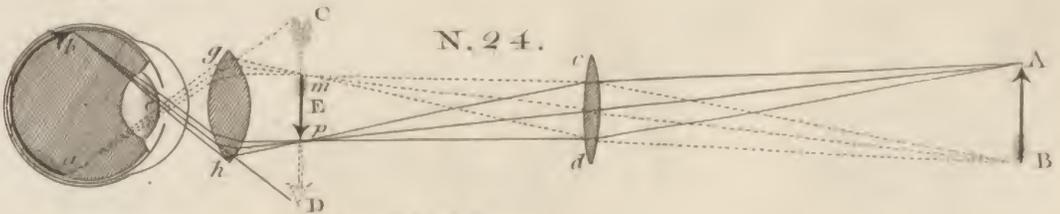
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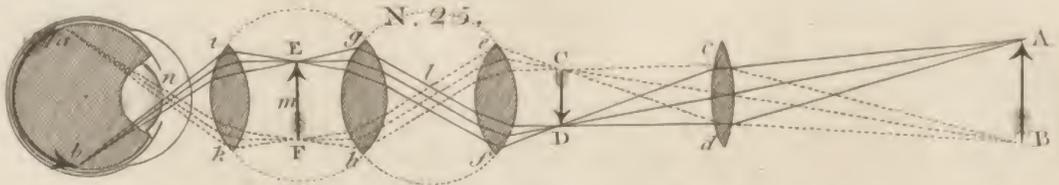
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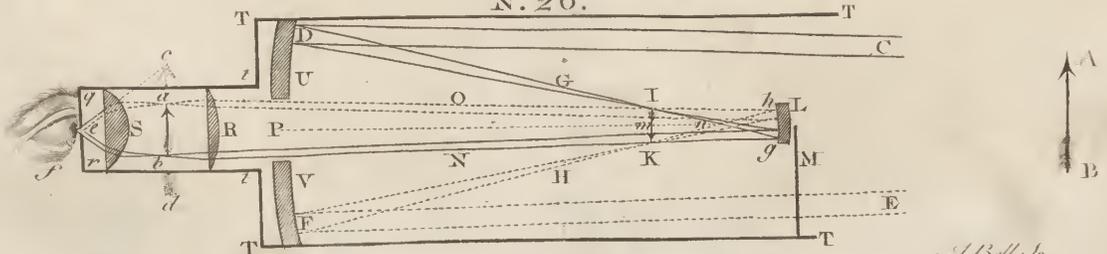
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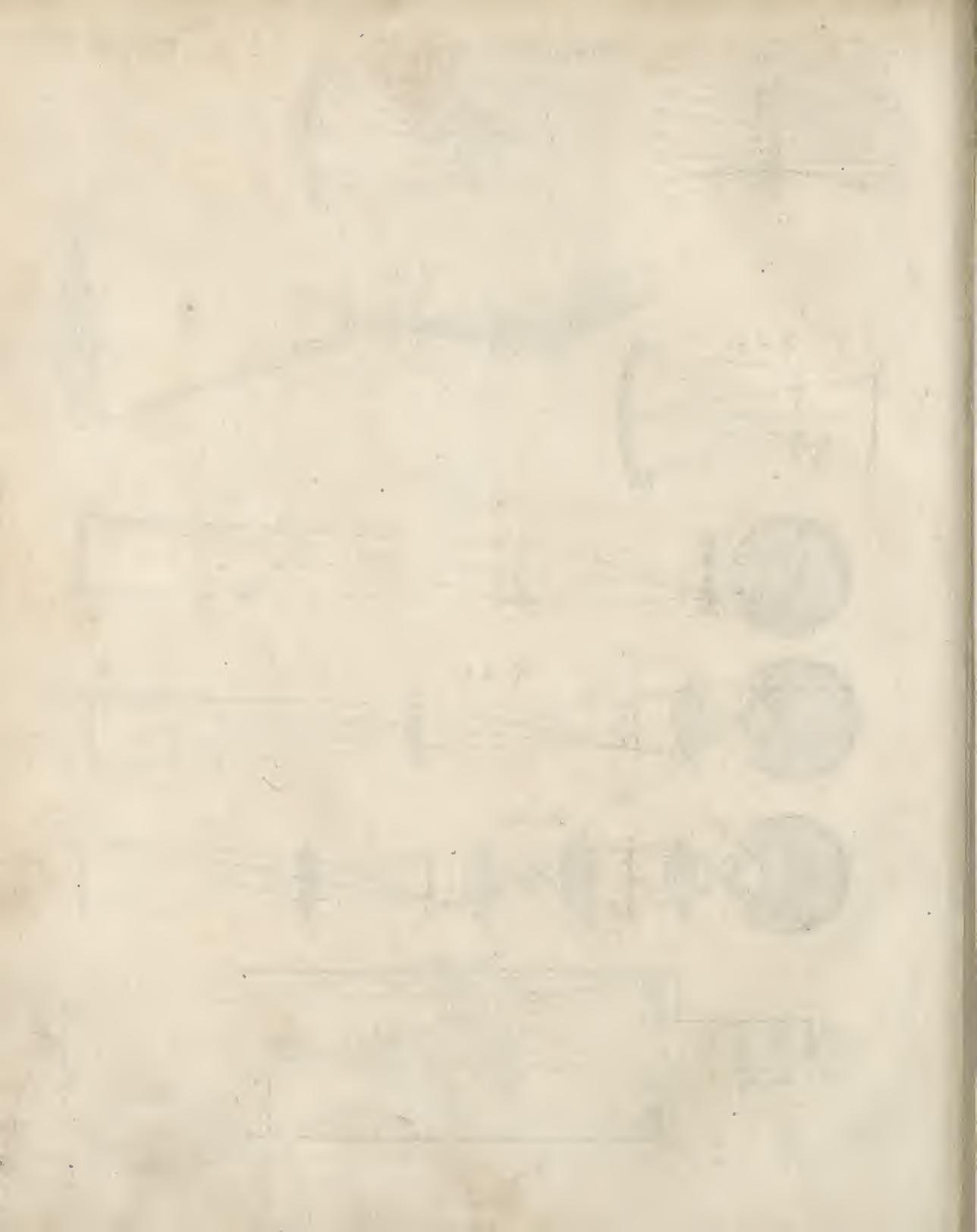


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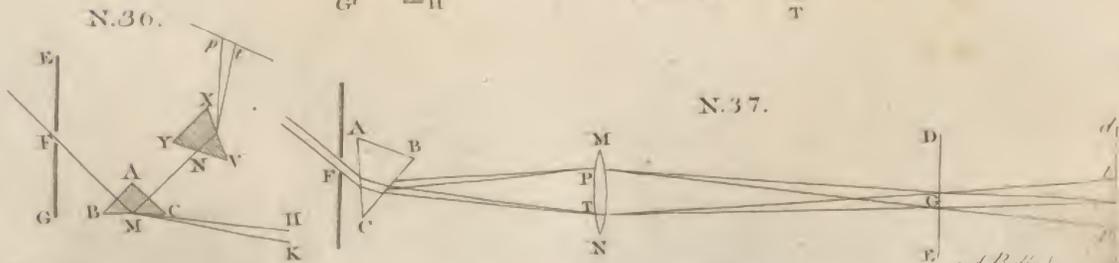
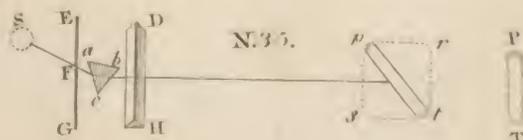
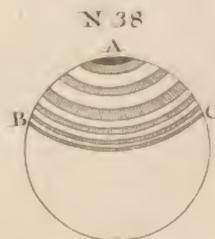
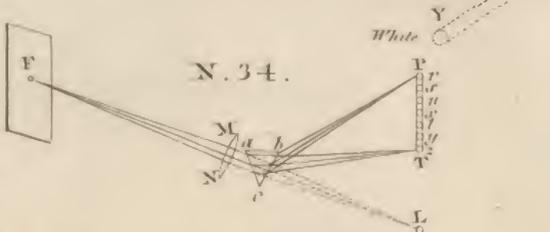
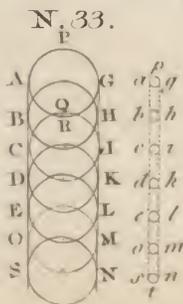
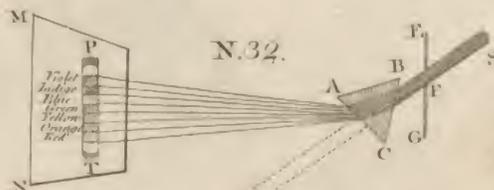
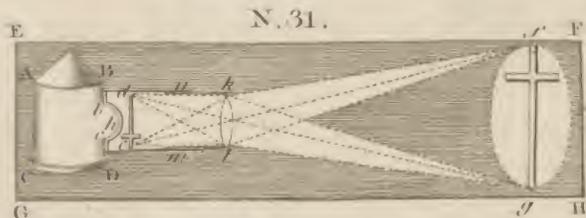
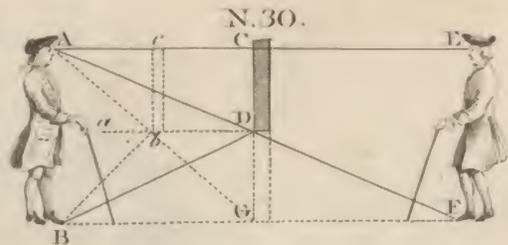
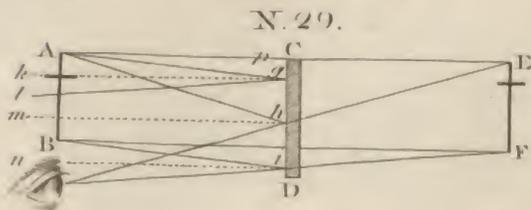
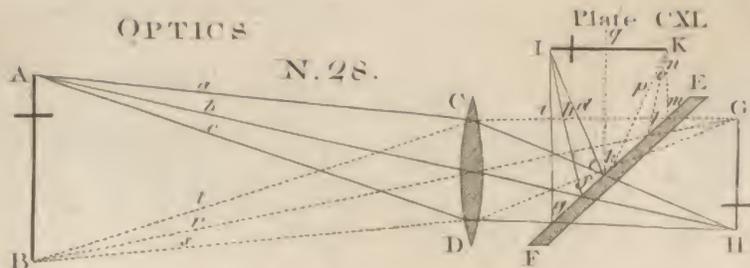
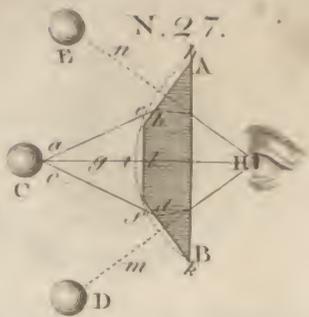
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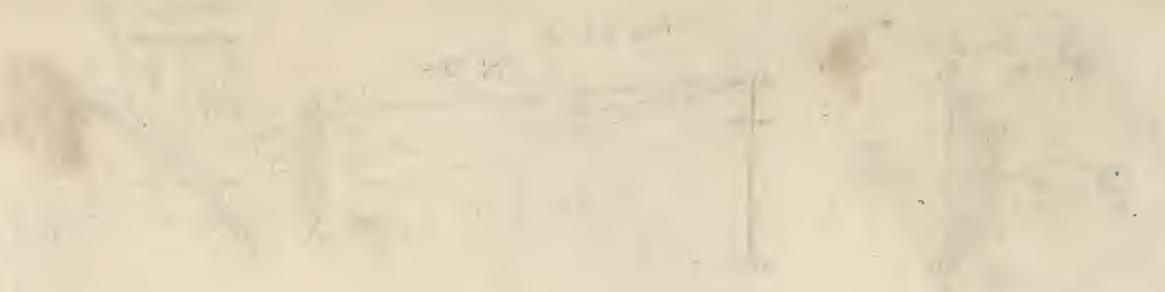


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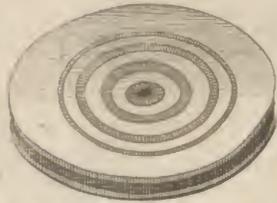
Plate CXL



N. 37.



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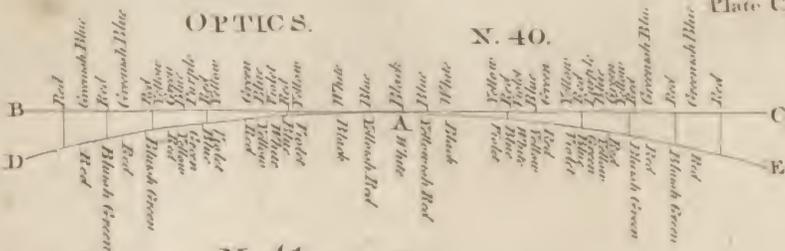
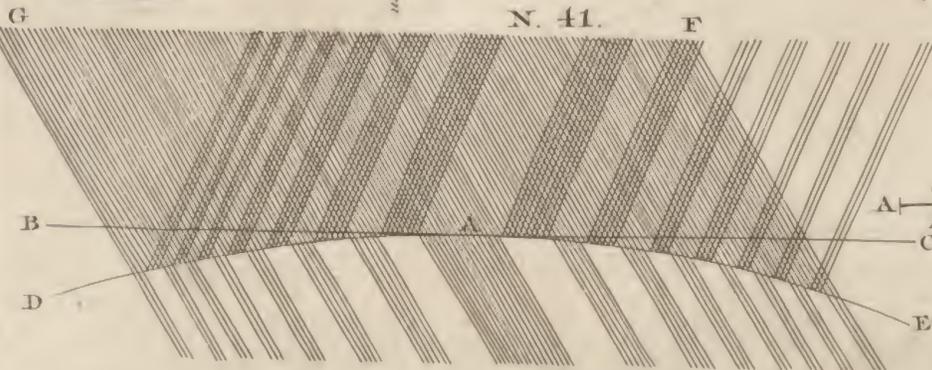
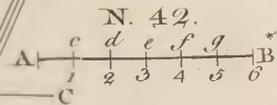


Plate CXLI.

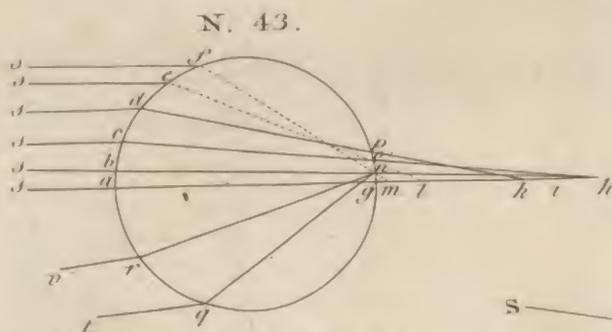
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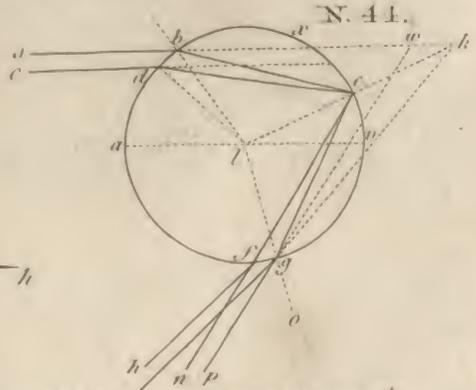
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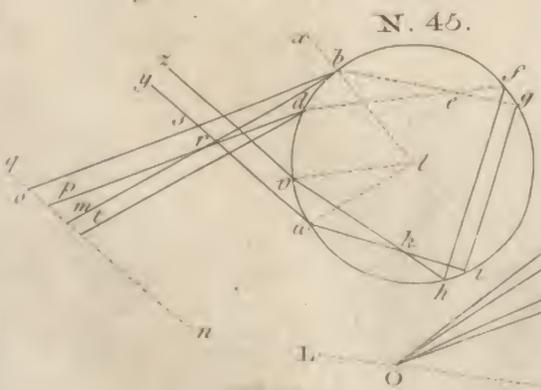
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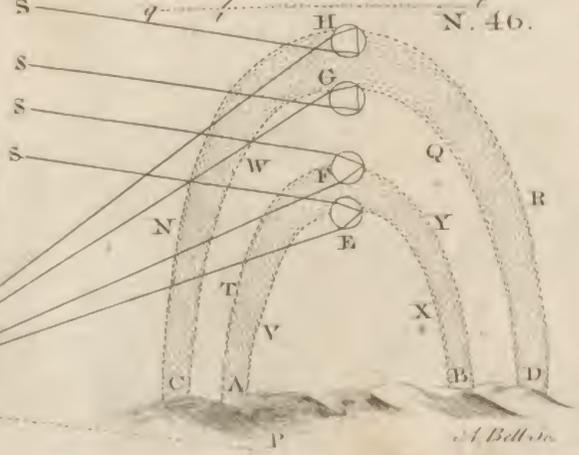
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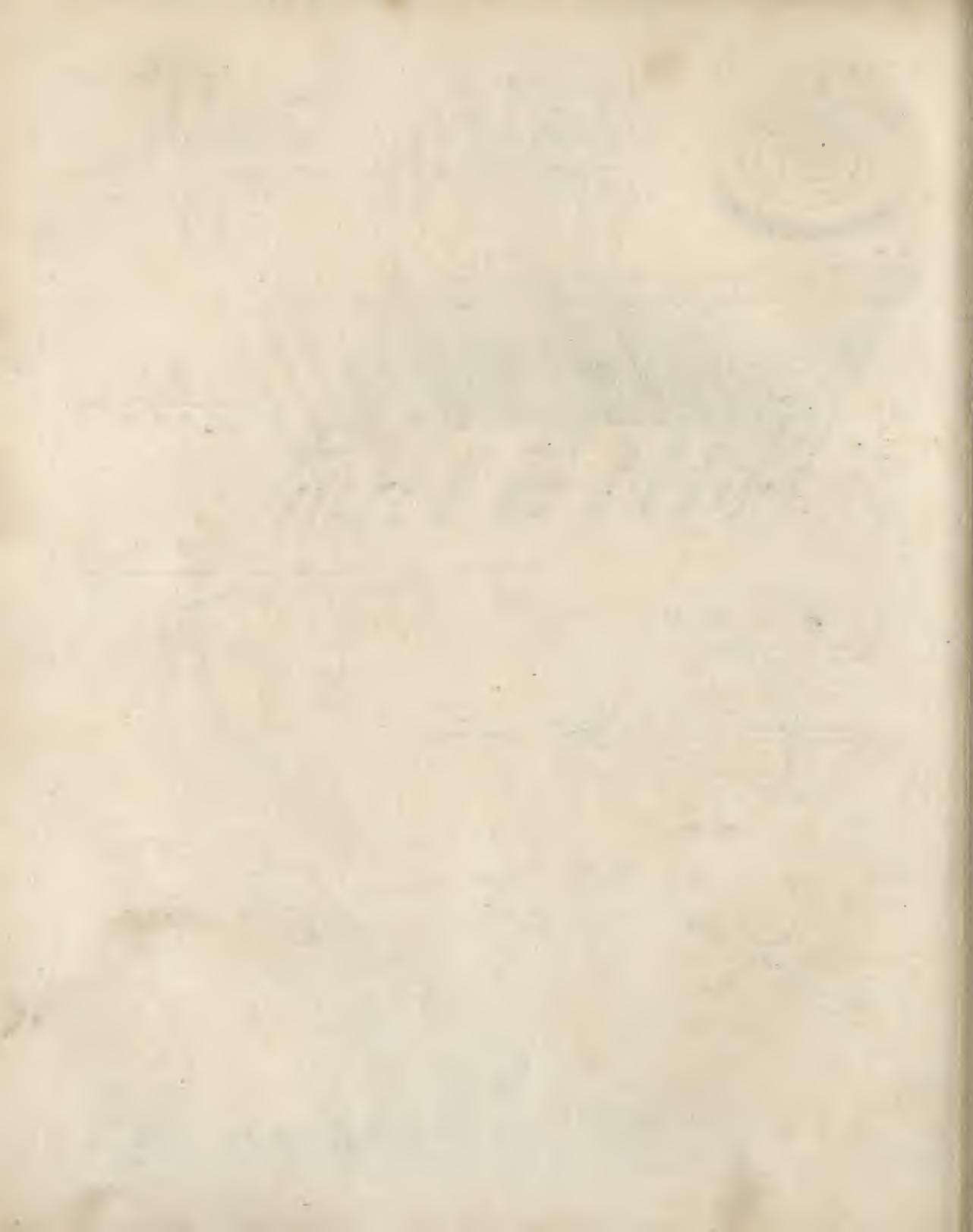


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A. Bellin.



in all the magazines, garrisons, and forts, in Great Britain.

**ORDONNANCE**, in architecture, is the composition of a building, and the disposition of its parts, both with regard to the whole and to one another; or, as Mr. Evelyn expresses it, determining the measure of what is assigned to the several apartments.

**ORE**, in natural history, the compound mineral glebe, earth, stone, or other substance, which is rich enough in metallic particles to be worth the while of being purified, and by this means to separate the metal from it, whether gold, silver, copper, &c. See **CHEMISTRY**.

**OREBRO**, the capital of the province of Nericia, in Sweden: E. long. 15°, N. lat. 59° 20'.

**OREGRUND**, a port-town of Sweden, in the province of Upland: E. long. 18° 15', N. lat. 60° 30'.

**ORFORD**, a borough and port town of Suffolk, thirty miles east of Bury. It sends two members to parliament.

**ORGAL**, among dyers, denotes the leas of wine dried.

**ORGAN**, in general, is an instrument or machine designed for the production of some certain action or operation; in which sense, the mechanic powers, machines, and even the veins, arteries, nerves, muscles, and bones of the human body, may be called organs.

**ORGAN**, in musick, the largest and most harmonious wind-instrument.

The invention of the organ is very ancient, though it is agreed that it was very little used till the eighth century. It seems to have been borrowed from the Greeks. Vitruvius describes an hydraulic one in his tenth book of architecture. The emperor Julian has an epigram in its praise. St. Jerome mentions one with twelve pair of bellows, which might be heard a thousand paces, or a mile; and another at Jerusalem, which might be heard at the mount of Olives.

There is one in the cathedral church of Ulm, in Germany, that is ninety-three feet high, and twenty-eight broad; the biggest pipe is thirteen inches in diameter; and it has sixteen pair of bellows.

The modern organ is a buffet, containing several rows of pipes. The size of the organ is generally expressed by the length of its biggest pipe; thus we say an organ of thirty-two feet, of sixteen, of eight, and of two feet.

**Hydraulic ORGAN**, denotes a musical machine that plays by means of water instead of wind. Of these there are several in Italy in the grottoes of vineyards. Ctesebes of Alexandria, who lived in the time of Ptolemy Euergetes, is said to have first invented organs that played by compressing the air with water, as is still practised. Archimedes and Vitruvius have left us descriptions of the hydraulic organ.

**ORGASM**, an ecstasy, or impetuous desire of coition, occasioned by a turgescency of the seminal vessels.

**ORGIA**, in antiquity; feasts and sacrifices performed in honour of Bacchus, instituted by Orpheus, and chiefly celebrated on the mountains by wild distracted women, called Bacchæ. See **BACCHANALIA**, and **DIONYSIA**.

**ORGIVA**, a town of Spain, in the province of Granada, twenty-five miles south of Granada.

**ORGUES**, in the military art, are thick, long pieces of wood, pointed at one end, and shod with iron, clear one of another; hanging each by a particular rope, or cord, over the gate-way of a strong place, perpendicularly, to be let fall in case of an enemy.

**ORGUES** is also used for a machine, composed of several harquebuss or musquet-barrels bound together, by means whereof several explosions are made at the same time, used to defend breaches and other places attacked.

**ORGYA**, an ancient Grecian measure, containing six feet.

**ORIA**, a town of Italy, in the kingdom of Naples, and territory of Otranto, situated thirty miles north-west of the city of Otranto.

**ORIFICE**, the mouth or aperture of a tube, pipe, or other cavity.

**ORIGANUM**, in botany, a genus of the didymia gymnosperma class. The strobilus is triangular and spiked. There are eleven species, two of which are natives of Britain, viz. the vulgare, or wild marjoram; and the onites, or pot-marjoram.

**ORIGENISTS**, in church-history, a Christian sect in the fourth century, so called from their drawing their opinions from the writings of Origen. The origenists maintained, that the souls of men had a pre-existent state; that they were holy intelligences, and had sinned in heaven before the body was created: that Christ is only the son of God by adoption: that he has been successively united with all the angelical natures, and has been a cherub, a seraph, and all the celestial virtues, one after another: that in future ages, he will be crucified for the salvation of the devils, as he has already been for that of men; and that their punishment, and that of the damned, will continue only for a certain limited time.

**ORIGINAL**, a first draught or design of any thing, which serves as a model to be imitated or copied.

**ORIGINAL SIN**, the crime of eating the forbidden fruit, of which it is said all mankind are guilty at their conception by the imputation of Adam's transgression; which is accounted for by supposing, that Adam, as he was to be the father, was also the federal head and representative, of the whole human race; and that on his sinning, all that were to spring from him partook of his crime.

**ORIGUELLA**, a city of Spain, in the province of Valencia: W. long. 50', N. lat. 38° 20'.

**ORILLON**, in fortification, is a small rounding of earth faced with a wall; raised on the shoulder of those bastions that have casemates, to cover the cannon in the retired flank, and prevent their being dismounted by the enemy. See **FORTIFICATION**.

**ORIOLOUS**, in ornithology, a genus belonging to the order of picæ. The bill is conical, convex, very sharp, and strait, the superior mandible being much longer than the under one; and the tongue is forked and sharp. There are 20 species, principally distinguished by their colour.

**ORION**, in astronomy. See **ASTRONOMY**, p. 487.

**ORIXA**, the capital of the province of the same name, in the hither India, situated on the west side of the bay of Bengal.

**ORKNEY ISLANDS**, certain islands on the north of Scotland, from which they are separated by a frith twenty miles in length, and ten in breadth. These islands are forty in number, and together with the island of Zetland send one member to parliament, and another for the burghs of Kirkwall, &c.

**ORLE**, **ORLET**, or **ORLO**, in architecture, a fillet under the ovolo or quarter round of a capital. When it is at the top or bottom of the shaft, it is called cincture.

- Palladio uses the word orlo, for the plinth of the bases of the columns.
- ORLE**, in heraldry, an ordinary, in form of a fillet, drawn round the shield, near the edge or extremity thereof, leaving the field vacant in the middle. Its breadth is but half that of the tressure or bordure, which contains a sixth part of the shield; and the orle, only a twelfth: besides that the orle is its own breadth distant from the edge of the shield, whereas the bordure comes to the edge itself. The form of the orle is the same with that of the shield; whence it resembles an escutcheon. See Plate CXXXIV. fig. 6. which represents an orle argent in a field gules.
- ORLEANOIS**, a province or government of France, bounded by Normandy and the isle of France, on the north; by Champaign and Burgundy, on the east; by Lyons and Guienne, on the south; and by Britany and the bay of Biscay, on the west.
- ORLEANS**, a city of France, capital of Orleanois, situated on the river Loire, in E. long. 2°, N. lat. 47° 55'.
- ORLEANS** is also the name of an island and town on the river of St. Laurence, in Canada: W. long. 73°, N. lat. 47°.
- ORLOPE**, in the sea-language, the uppermost space or deck in a great ship, reaching from the main-mast to the mizen. In three-deck ships, the second and lowest decks are sometimes called orlopes.
- ORMOND**, the north division of the county of Tipperary in Ireland.
- ORMUS**, an island at the entrance of the gulph of Persia, situated opposite to Combron on the continent, in E. long. 56°, N. lat. 27° 30'.
- This island is thirty miles in circumference.
- ORNITHOGALUM**, in botany, a genus of the hexandria monogynia class. The corolla consists of six erect petals; and the filaments are alternately wider at the base. There are 11 species, three of them natives of Britain, *viz.* the luteum, or yellow star of Bethlehem; the pyrenaicum, or spiked star of Bethlehem; and the umbellatum, or common star of Bethlehem.
- ORNITHOLOGY**, that branch of natural history which treats of birds. See NATURAL HISTORY.
- ORNITHOMANCY**, a species of divination, performed by means of birds; being the same with augury. See DIVINATION and AUGURY.
- ORNIOPHUS**, in botany, a genus of the diadelphia decandria class. The pod is jointed, cylindrical, and arcuated. There are four species, only one of which, *viz.* the perupissus, or birds-foot, is a native of Britain.
- OROBANCHE**, in botany, a genus of the didynamia angiospermia class. The calix is biseid, and the corolla ringent; the capsule has two valves, and contains many seeds. There are seven species, two of them natives of Britain, *viz.* the major, or broom-rape; and the ramosa, or branched broom-rape.
- OROBUS**, in botany, a genus of the diadelphia decandria class. The stylus is linear; the calix is blunt at the base, the superior segments of it being shorter. There are nine species, two of them natives of Britain, *viz.* the tuberosus, or wood-pease; and the sylvaticus, or bitter vetch.
- ORONOQUE**, a river of South America, which falls into the Atlantic ocean in 8° N. lat. almost opposite to the island of Trinity.
- ORONTIUM**, in botany, a genus of the hexandria monogynia class. The spadix is cylindrical, and covered with fibules; the corolla consists of six petals; it has no stylus; and the capsule has three cells. There is but one species, a native of Virginia.
- ORPHAN**, a fatherless child, or minor; or one that is deprived both of father and mother.
- ORPHUS**, in ichthyology. See SPARUS.
- ORPIMENT**, in natural history, a fossile substance usually found in copper-mines, composed of thin flakes, like the talcs; which easily split, and are flexible, and not elastic, soluble in oil, fusible in a moderate fire, and yielding in burning an offensive smell like garlic.
- Of this genus of fossils, there are only three known species: 1. A broad-flaked, gold-coloured kind, much esteemed at present by our painters. This is found in several places, as in the islands of the Archipelago, in the mines of Gosselaer in Saxony, in some parts of Turkey, and in the East-Indies, and in its utmost purity about Smyrna; this makes the finest of all yellows in painting. 2. The small-flaked yellow kind, which is the common orpiment of the shops, and is a fine colour, though greatly inferior to the former. This is found in many parts of the Turkish dominions, and in Germany. And, 3. Red-orpiment, which is of a fine bright red: this is a very beautiful substance of a fine bright red, very glossy, and a little transparent, and is found in the Turkish dominions, in the islands of the Archipelago, and even in Cornwall, where it is known under the name of red mundic.
- Geoffroy declares it a corrosive and poisonous mineral: on the other hand, Boerhaave declares orpiment an innocent and harmless medicine; and Hoffman, who has been at more pains than any body to examine into its nature, declares the same, and even gives instances of its being given to dogs without any harm.
- It is an excellent depilatory, mixed with lime, and made into a paste with water. The painters are fond of it as a golden colour; and a lixivium of it, with quick-lime, makes sympathetic ink.
- ORPINE**, in botany. See SEDUM.
- ORRERY**, a curious machine, or movement, for representing the motions and appearances of the heavenly bodies. See ASTRONOMY, p. 495.
- ORRICE**. See IRIS.
- ORTEGAL castle and cape**, the most northerly promontory of Spain, thirty miles north-east of Ferrol: W. long. 8° 22', N. lat. 44°.
- ORTEGIA**, in botany, a genus of the triandria monogynia class. The calix consists of five leaves; the corolla is wanting; and the capsule has one cell, and many seeds. There is but one species; a native of Spain.
- ORTHODOX**, in church-history, an appellation given to those who are found in all the articles of the Christian faith.
- ORTHOGRAPHIC projection of the sphere**, that wherein the eye is supposed at an infinite distance; so called, because the perpendiculars from any point of the sphere will all fall in the common intersection of the sphere, with the plane of the projection.

**ORTHOGRAPHY**, that part of grammar which teaches the nature and affections of letters, and the just method of spelling or writing words with all the proper and necessary letters, making one of the four greatest divisions or branches of grammar. See **GRAMMAR**.

**ORTHOGRAPHY**, in geometry, the art of drawing or delineating the fore-right plan of any object, and of expressing the heights or elevations of each part. It is called orthography, from its determining things by perpendicular lines falling on the geometrical plane.

**ORTHOGRAPHY**, in architecture, the elevation of a building.

**ORTHOGRAPHY**, in perspective, is the fore-right side of any plane, *i. e.* the side or plane that lies parallel to a straight line, that may be imagined to pass through the outward convex points of the eyes, continued to a convenient length.

**ORTHOPNOEA**, in medicine, a species or degree of asthma, where there is such a difficulty of respiration, that the patient is obliged to sit or stand upright, to be able to breathe. See **MEDICINE**.

**ORTON**, a market town of Westmoreland, situated ten miles south-west of Appleby.

**ORVALA**, in botany, a genus of the didymia gymnospermia class. The superior lip of the corolla is divided into three segments, each being toothed; and the inferior lip is cordate and crenated. There is but one species, a native of Italy.

**ORVIETTO**, a city of Italy, in the pope's territories, capital of the province of Orvietto, situated at the confluence of the Tiber and the Chiane: E. long. 13°, N. lat. 43°.

**ORWELL**, a river of Suffolk, which, rising in the middle of that country, runs south-east by Ipswich, and falls into the German sea at Langard-fort.

**ORYZA**, **RICE**, in botany, a genus of the hexandria digynia class. The calix is a double-valved glume, with one flower; and the corolla consists of two equal valves. There is but one species.

This plant is cultivated in vast abundance in the East, as also in Carolina, for food. It is said to be good in dysenteries, diarrhoeas, &c.

**OSACA**, a great city and port-town of Japan, situated on a bay of the sea, on the east side of the island: in E. long. 135°, N. lat. 35°.

**OSBECKIA**, in botany, a genus of the octandria monogynia class. The calix consists of four segments, and the corolla of four petals; and the capsule has four cells. There is but one species, a native of India.

**OSCHEOCELE**, in surgery, a hernia of the scrotum. See **SURGERY**.

**OSCILLATION**, in mechanics, the vibration, or reciprocal ascent and descent of a pendulum. See **MECHANICS**.

**OSMUNDA**, in botany, a genus of the cryptogamia filicum class. The spike is full of branches, and the fructification is round. There are 17 species, none of them natives of Britain.

**OSNABURG**, the capital of the bishopric of the same name, in the circle of Westphalia: E. long. 7° 40', N. lat. 52° 31'. The territories of this bishopric, which are forty miles long, and thirty broad, are subject to its bishop: and this bishopric is alternately held by a protestant and

papist, the protestant being always a prince of the house of Brunswic.

**OSORNO**, a town of Chili in South America: W. long. 80°, S. lat. 41°.

**OSPREY**. See **FALCO**.

**OSSIFICATION**, the formation of bones, but more particularly the conversion of parts naturally soft to the hardness and consistence of bones. See **ANATOMY**, p. 148.

**OSSORY**, the west division of Queen's county in Ireland.

**OSSUNA**, a town of Spain, in the province of Andalusia, forty miles east of Seville.

**OSTAGIO**, a town of Italy in the territory of Genoa, fifteen miles north-west of Genoa.

**OSTEND**, a city and port-town of the Austrian Netherlands, in the province of Flanders, situated twelve miles west of Bruges: E. long. 2° 45', N. lat. 51° 15°.

**OSTEOCOLLA**, in natural history, though supposed by many to be an earth, is truly a crustated kind of spar, debased by earth, and therefore not transparent.

It is usually found coating over vegetable, or other bodies, in form of incrustations; so that the true osteocollas is a tubular crustaceous spar, of a very foul and coarse texture, and carries with it much more of the appearance of a marl than of a species of spar.

The masses of osteocollo, though regularly of the same figure, are very different in size; some of them being not thicker than a crow-quill, and others of five and six inches diameter; it is always, however, of a tubular figure, and a wrinkled and rough surface.

Osteocollo is frequent in Germany, where it is found buried near the surface of the earth, sometimes in strata of sand, but more frequently among marls: it should be chosen for use, the purest that can be had of a pale brown colour, and of a tolerably close and firm texture.

It has long been famous for bringing on a callus in fractured bones; its name osteocollo signifying the bone-glu, or bone-binder. It is also recommended as a diuretic, and as good in the fluxus albus: but, at present, little regard is paid to it; since, if it has any virtues, they must be wholly owing to spar, which may be given to greater advantage in a purer form.

**OSTEOLOGY**, that branch of anatomy which treats of the bones. See **ANATOMY**, Part I.

**OSTEOSPERMUM**, in botany, a genus of the syngenesia polygamia necessaria class. The receptacle is naked; it has no pappus; the calix consists of many leaves; and the seeds are round and hard. There are five species, none of them natives of Britain.

**OSTIA**, a port-town of Italy, in the pope's territories, situated at the mouth of the Tiber: E. long. 13°, N. lat. 41° 30'.

**OSTRACION**, in zoology, a genus of the amphibia nantes class. It has ten long, cylindrical, obtuse teeth in each jaw; the aperture is linear; the body is covered with a bony substance; and it has no belly-fins. There are nine species, principally distinguished by the angles of their bodies and the number of spines near the tail.

**OSTRACISM**, in Grecian antiquity, denotes the banishment of such persons whose merit and influence gave umbrage to the people of Athens, lest they should attempt any thing against the public liberty. It was so called, because the peo-

- ple voted a person's banishment, by writing his name on shells, and casting them into an urn.
- OSTRACITES**, in natural history, the name by which authors call the fossil oyster-shell.
- Ostracites has the same medicinal virtues with the blemnites, and lapis judaicus, only in a higher degree; being accounted by Dr. Lister one of the greatest known medicines in nephritic cases: the dose, in powder, is from half a dram to a dram, in white-wine; and to prevent a sickness at the stomach, that sometimes attends the taking it, one third part of the quantity of powdered chamomile-flowers may be mixed with it.
- OSTREA**, the **OYSTER**, in zoology, a genus belonging to the order of vermes testacea. The shell has two unequal valves; the cardio has no teeth, but a small hollow pit, with transverse lateral streaks. There are 31 species, principally distinguished by peculiarities in their shells. The common oyster is used both raw, and variously prepared as food.
- OSTRICH**, in ornithology. See **STRUTHIO**.
- OSWEGO**, a town of the Iroquois, in North America, three hundred miles west of Albany, in New-York.
- OSWESTRY**, a market-town in Shropshire, fifteen miles north-west of Shrewsbury.
- OSYRIS**, in botany, a genus of the diœcia triandria class. The calix of both male and female consists of three segments; neither of them have any corolla; the female has no stylus, but a roundish stigma; and the drupa has but one cell. There is only one species, a native of Italy.
- OTHONNA**, in botany, a genus of the syngenesia polygamia necessaria class. The receptacle is naked; it has no pappus; and the calix is somewhat cylindrical, and consists of many leaves. There are seven species, two of them natives of Britain, *viz.* the palustris, or marsh sea-bane; and the integrifolia, or mountain ragwort.
- OTIS**, in ornithology, a genus of birds belonging to the order of grallæ. The superior mandible of the bill is arched; the nostrils are oval; the tongue is bifid; the feet are made for running, being furnished with four toes. There are four species, principally distinguished by their colour.
- OTLEY**, a market-town, twenty-one miles west of York.
- OTOQUE**, an island situated in the bay of Panama, from whence the city is furnished with provisions: W. long. 82°, N. lat. 7°.
- OTRANTO**, a city and archbishop's see of the kingdom of Naples, situated at the entrance of the gulph of Venice: E. long. 19° 15', N. lat. 40° 12'.
- OTTER**, in zoology. See **MUSTELA**.
- OTTOMAN**, or **OTHOMAN**, an appellation given to the Turkish empire, from Othomannus, or Osmanhus, the first emperor of the present family.
- OTTONA**, or **ORTONA**, a city of the kingdom of Naples, situated on the gulph of Venice: in E. long. 15° 30', N. lat. 42° 22'.
- OVAL**, an oblong curvilinear figure, otherwise called elliptis. See **CONIC SECTIONS**.
- OVARIES**, in anatomy. See **ANATOMY**, p. 275.
- OVATION**, in the Roman antiquity, a lesser triumph, allowed to commanders for victories won without the effusion of much blood; or for defeating a mean and inconsiderable enemy. The show generally began at the Albanian mountain, whence the general with his retinue made his entry into the city on foot, with many flutes or pipes sounding in concert as he passed along, and wearing a garland of myrtle as a token of peace. The term ovation, according to Servius, is derived from *ovis*, sheep, because on this occasion the conqueror sacrificed a sheep, as in triumph he sacrificed a bull.
- UDENARDE**, a town of the Austrian Netherlands, in the province of Flanders, situated on the river Scheld, thirteen miles south of Ghent.
- UDENBURG**, a town of the Austrian Netherlands, in the province of Flanders, five miles south-east of Ostend.
- OVERHALE**, in the sea-language. A rope is said to be overhauled when drawn too stiff, or haled the contrary way.
- OVER-RAKE**, among seamen: When a ship, riding at anchor, so overbeats herself into an high sea, that she is washed by the waves breaking in upon her, they say the waves over-rake her.
- OVERSMAN**, in Scots law; a person named by arbiters, or by the parties submitters, to determine the matter submitted, in case the parties disagree in their opinion.
- OVERT**, the same with open: thus an overt act signifies an act which, in law, must be clearly proved; and such is to be alleged in every indictment for high treason.
- OVERTURE**, or **OUVERTURE**, opening or prelude; a term used for the solemnities at the beginning of a public act or ceremony; an opera, tragedy, concert of music, &c.
- The overture of the theatre, or scene, is a piece of music usually ending with a fugue: the overture of a jubilee is a general procession, &c.
- OVERYSCHÉ**, a town of the Austrian Netherlands, in the province of Brabant, situated on the river Ysche, nine miles north-east of Brussels.
- OVERYSSEL**, one of the united provinces, bounded by Groningen on the north, by Westphalia on the east, by Zutphen on the south, and by Guelderland, the Zuyder-sea, and Friesland, on the west.
- OVIDA**, in botany, a genus of the didynamia angiospermia class. The calix consists of five segments; the corolla is a long cylindrical tube; and the berry is round, containing two seeds. There are two species, none of them natives of Britain.
- OVIEDO**, a city of Spain, capital of the province of Asturias; situated on the river Asta, fifty miles north of Leon, in W. long. 6° 40', N. lat. 43° 30'.
- OVLIA**, or **SEPTA**, in ancient Rome, a place in the campus martius, at first railed in like a sheep-pen, whence its name. Afterwards it was mounted with marble, and beautified with walks and galleries, as also with a tribunal, or seat of justice. Within this precinct, or inclosure, the people were called in to give their suffrages for the election of magistrates. The ascent into the ovilia was not by stairs, but by pontes, or narrow boards, laid there for the occasion; on which account *de ponte dejici* was to be denied the privilege of voting; and persons thus dealt with, were called depontani.
- OVIPAROUS**, a term applied to such animals as bring forth their young from eggs; as birds, insects, &c.
- OVIS**, in zoology, a genus of the mammalia class, and of the order of pecora; the characters of which are these: The horns are concave, turned backwards, twisted, and full of wrinkles; there are eight foreteeth in the under jaw, and no dog-teeth. The species are three, *viz.*
1. Aries,

1. *Aries*, or ram and sheep, the horns of which are shaped like a half moon, and compressed. This animal is perhaps the most gentle and inoffensive, and at the same time the most timid and stupid, of all quadrupeds. In a flock of sheep, there is always a leader, whose steps the rest implicitly and blindly follow. If he runs over a precipice, the whole flock follow his example, and cannot be restrained though evident destruction be the consequence. The smallest noise, if uncommon, makes them run precipitantly against each other, without knowing the cause of their danger, or being able to extricate themselves. In snow, they remain fixed in the same spot; and continue obstinately in that situation, unless they are forced to move by the shepherd or his dog. But though dastardly in itself, though almost devoid of sentiment and mental qualities, this animal is of the most extensive utility to man. It affords us both food and cloathing, besides the advantages we derive from its milk, its skin, and its tallow.

Love, the liveliest sentiment in all animals, is the only passion which inspires the ram with any degree of vivacity; when under the influence of this passion, he becomes petulant, runs against his neighbours, and sometimes even attacks the shepherd himself. But the ewe, or female, though in the same situation, does not appear to be in the least affected; she seems to have no other instinct than that of simply admitting the embraces of the ram, eating her food, and recognising her offspring; the lamb, on the other hand, is endowed with the same instinct of distinguishing its mother from the rest of the flock.

This animal, so soft and so simple in its nature and disposition, is likewise extremely weak and feeble in its constitution: They can endure but little fatigue; whenever they run, their hearts palpitate, and their wind fails them; they are equally incapable of bearing heat or cold, snow or rain: They are subject to many diseases, most of which are contagious: They bring forth their young with pain and difficulty, and require more care and attention than any other domestic animal.

The ram is capable of generation at the age of 18 months; and the ewe can be impregnated when a year old. One ram is sufficient for 30 or 40 ewes. He ought to be strong, well proportioned; his head should be thick and strong, his front large, his eyes black, his nose flat, his neck thick, his body long and tall, his testicles massy, and his tail long. White is the best colour for a ram. The ewes whose wool is most plentiful, bushy, long, soft, and white, are most proper for breeders, especially when at the same time they are of a large size, have a thick neck, and move nimbly.

Ewes are generally in season from the end of October to the beginning of April: However, they may be impregnated at any time, if they be fed with stimulating nourishment, as salt water, and bread made of hemp-seed. They go with young about five months, and generally bring forth but one at a time, though frequently two: In warm climates, they may bring forth twice in a year; but in Britain, France, and most parts of Europe, only once. They give milk plentifully for seven or eight months: Their milk affords nourishment for children and country people; good cheese is made of it, especially when mixed with cow-milk. They live from 10 to 12 years, and are capable of bringing forth as long as they live.

When the male lambs are not intended to be kept for propagation, but fattened for food, they ought to be castrated at the age of five or six months. This operation is performed two ways: in the one, an incision is made and the testicles taken out; in the other, a ligature is tied tight round the scrotum, above the testicles, which soon destroys the vessels which nourish them. After castration, they are called weathers.

The ram, ewe, and weather, when one year old, lose the two foreteeth of the under jaw; six months afterwards, they lose the two foreteeth next to these; and at the age of three years, the teeth are all replaced. The age of a ram may likewise be discovered by their horns, which always appear the first year, and frequently as soon as they are brought forth. These horns uniformly acquire an additional ring every year as long as the creature lives. The ewes commonly have no horns, but a kind of long protuberances in place of them: However, some of them have two, and some four horns.

In Spain, and the southern parts of Europe, the flocks are kept in shades or stables during the night: but in Britain, where there is now no danger from wolves, they are allowed to remain without, both night and day; which makes the animals more healthy, and their flesh a more whole food. Dry and mountainous grounds, where thyme and sheep's fescue grafs abound, are the best for the pasturing sheep.

2. The *Guineensis*, or Guinea sheep, has pendulous ears, lax hairy dew laps, and a prominence on the hind part of the head. The wool is short, like that of a goat. It is a native of Guinea.

3. The *Strepsiceros*, or Cretan sheep, has strait carinated horns, twisted in a spiral manner. It is a native of Mount Iola.

**OULNEY**, a market-town of Buckinghamshire, situated nine miles south-east of Northampton.

**OULZ**, a town of Italy, in the province of Piedmont, situated in E. long. 6° 30', N. lat. 45°.

**OUNCE**, a little weight, the sixteenth part of a pound avoirdupois, and the twelfth part of a pound troy.

**OUNCE**, in zoology. See **LEO**.

**OUNDLE**, a market-town of Northamptonshire, situated on the river Nen, twenty-two miles north-east of Northampton.

**OVOLO**, or **Ovum**, in architecture, a round moulding, whose profile, or sweep, in the ionic and composite capitals, is usually a quadrant of a circle: whence it is also commonly called the quarter-round.

It is usually cut with the representation of eggs and anchors or arrows heads placed alternately.

**OUSE**, a river, which, rising in the north of Yorkshire, runs south-east by York; and, continuing that course, falls into the Trent.

**OUSE**, is also a river which rises on the confines of Oxfordshire and Buckinghamshire; and running north-east through Buckinghamshire, Bedfordshire, Huntingdonshire, Cambridgeshire, and Norfolk, passes by Buckingham, Bedford, Huntington, and Ely, discharging itself into the bay of the German sea at Lynn.

**OUSTIACH**, or **Ostiach Country**, is a part of Asiatic Russia, extending along the river Irtis to its confluence with the river Oby; and from thence northward along the banks of the Oby and Jenisa, into the gulph of the Mangasea, or the frozen ocean; and extending also along

the banks of several rivers which fall into the Oby and Jenisa.

**OUTLAW**, signifies one that is deprived of the benefit of the law, and therefore held to be out of the king's protection. See the next article.

**OUTLAWRY**, is where a person is outlawed, and on that account loses the benefit of a subject,

The process of outlawry lies in indictments of treason or felony, and also of trespass *vi & armis*, conspiracy, &c. And by statute, persons may be outlawed in many civil actions, as debt, case, covenant, &c.

**OUTWORKS**, in fortification, all those works made without-side the ditch of a fortified place, to cover and defend it. See **FORTIFICATION**.

**OUZEL**, in ornithology. See **MOTACILLA**.

**OWL**, in ornithology. See **STRIX**.

**OX**, in zoology. See **Bos**.

**OXALIS**, in botany, a genus of the decandria pentagynia class. The calix consists of five leaves; the petals are connected by the claws; and the capsule has five sides. There are 14 species, only one of them, *viz.* the acetosella, or wood-forrel, is a native of Britain.

**OXFORD**, the capital of Oxfordshire, and the see of a bishop; it is situated at the confluence of the Isis and Cherwell, fifty-five miles west of London: W. long. 1° 15', and N. lat. 51° 45'.

Oxford is most remarkable on account of its university, which consists of twenty colleges and five halls: this city sends two members to parliament, and the university as many.

**OXGANG**, or **OXGATE**, is generally taken, in our old law-books, for fifteen acres, or as much ground as a single ox can plough in a year.

**OXUCLÆ**, in natural history, the name of a genus of fossils of the class of the selenitæ, but of the columnar, not the rhomboidal kind.

Of this genus there are only two known species. 1. A fine kind, with thin flakes and transverse filaments, found in the clayey banks of the river Nen, near Peterborough, in Northamptonshire; and; 2. A dull kind, with thick plates and longitudinal filaments. This is not uncommon in Yorkshire, and lies sometimes in a yellow, sometimes in a blue clay.

**OXUS**, a river which rises in the mountains on the north of India; and running north-west, through Ubec Tartary, afterwards separates Persia from Ubec Tartary, and falls into the Caspian sea, in 44° N. lat.

**OXYCOCCUS**, in botany. See **VACCINIUM**.

**OXYCRATE**, in pharmacy, &c. a mixture of vinegar and water, proper to assuage, cool, and refresh: they make fomentations of oxycrate, clysters of oxycrate, &c. The usual proportion is one spoonful of vinegar to five or six spoonfuls of water.

**OXYCROCEUM**. in pharmacy, &c. a preparation much used in plasters for fractures, &c. made as follows: Take yellow wax, one pound; pitch and galbanum, each half a pound: melt them over a gentle fire; and then add of venice-turpentine, myrrh, and olibanum, each three ounces; saffron, two ounces: make them into a plaster.

**OXYGLYCU**, a species of drink prepared of the sweetest honey combs, macerated and boiled. The combs from which all the honey has been expressed, are put into a pot with pure water, and boiled till they seem to have deposited all their contained honey in the water. This liquor is to be kept, and, when diluted with cold water, is to be drank in the summer-time, in order to remove thirst.

**OXYMEL**, in pharmacy, a composition of vinegar and honey.

There are several sorts of oxymel, whereof the simple kind is made by boiling, in a glazed earthen vessel, and with a gentle fire, two pounds of clarified honey, in a pint of vinegar, to the consistence of a syrup.

**OYER**, in law-books, seems to have been anciently used for what is now called assise.

**OYER AND TERMINER**, a commission directed to the judge of assise, and other gentlemen, empowering them to hear and determine all criminal causes, and to try all offenders, whether for treason, felony, or trespass.

**OYES**, or **OYEZ**, signifies *Hear ye*; and is frequently used by the criers in our courts, on making proclamations, or to enjoin silence.

**OYSTER**, in zoology. See **OSTREA**.

**OZÆNA**, a foul and malignant ulcer of the nose, distinguished by its fetor, and often accompanied with a caries of the bones of the nose.



## P.

### P A C

**PABULUM**. See **FUEL** and **FIRE**.

**PACA**, in zoology. See **Mus**.

**PACE**, a measure taken from the space between the two feet of a man, in walking; usually reckoned two feet and a half, and in some men a yard or three feet.

The geometrical pace is five feet; and 60000 such paces make one degree of the equator.

**PACE**, in the manege, is of three kinds, *viz.* walk, trot, and gallop; to which may be added an amble, because some horses have it naturally.

### P A C

Horses which go shuffling or mixed paces, between the walk and amble, are for the most part of no value; which commonly proceeds from their fiery temper, and sometimes from a weakness in their reins or legs.

**PACHAMAC**, a temple of Peru, in South America, dedicated by the Indians to the supreme being: it gives its name to the adjacent country.

**PACHODECARHOMBIS**, in natural history, the name of a genus of fossils, of the class of the selenitæ, expressing a thick rhomboidal body, composed of ten planes.

**PACIFIC**

**PACIFIC OCEAN**, that vast ocean which separates Asia from America: it is called Pacific, from the moderate weather the first mariners who sailed in it met with between the tropics; and it was called fourth-sea, because the Spaniards crossed the isthmus of Darien from north to south, when they first discovered it: though it is properly the Western ocean, with regard to America.

**PACK**, in commerce, denotes a quantity of goods, made up in loads, or bales, for carriage.

A pack of wool is seventeen stone and two pounds, or a horse's load.

**PACKAGE**, is a small duty of one penny in the pound, paid for all goods not particularly rated.

**PACOS**, in zoology. See **CAMELUS**.

**PACTOLUS**, a river of Lydia in the lesser Asia, celebrated by the ancient poets for its golden sands.

**PADDOC**, or **PADDOC-COURSE**, a piece of ground encompassed with pales or a wall, and taken out of a park for exhibiting races with grey-hounds, for plates, wagers, or the like.

**PADERBORNE**, the capital of the bishopric of the same name in Westphalia: E. long. 8° 25', N. lat. 51° 45'.

**PADSTOW**, a market-town of Cornwall, thirty miles west of Launceston.

**PADUA**, the capital of the Paduan, in Italy, a city of a circular form, situated twenty-two miles west of Venice: E. long. 12° 15', N. lat. 45° 30'.

**PADUAN**, a province of Italy, in the territories of Venice, thirty-five miles long, and almost as much in breadth; bounded by the Trevisane on the north, by the duchy of Venice on the east, by the Polestin de Rovigo on the south, and by the Vicentin on the west.

**PADUAN**, among the medalists, a modern medal struck in imitation of the antique; or a new medal struck with all the marks and characters of antiquity.

**PADUS**, in botany. See **PRUNUS**.

**PÆAN**, among the ancient pagans, was a song of rejoicing sung in honour of Apollo, chiefly used on occasions of victory and triumph.

**PÆAN**, in the ancient poetry, a foot consisting of four syllables; of which there are four kinds, the pæan primus, secundus, &c.

The pæan primus consists of one long syllable and three short ones, or a trochæus and pyrrhichius, as *temporibus*; the pæan secundus consists of a short syllable, a long, and two short, or an iambus and a pyrrhichius, as *potentia*; the pæan tertius consists of two short syllables, a long and a short one, or a pyrrhichius and a trochæus, as *animatus*; the pæan quartus consists of three short syllables and a long one, or a pyrrhichius and iambus, as *celeritas*.

**PÆDEROTA**, in botany, a genus of the diandria monogynia class, of which there are two species, none of them natives of Britain.

**PÆDO-BAPTISM**, infant-baptism, or that conferred on children.

**PÆONIA**, in botany, a genus of the polyandria digynia class. The calix consists of five leaves, and the corolla of five petals; the stylus is wanting; and the capsule contains many seeds. There are two species, none of them natives of Britain.

The root of this plant is a very celebrated medicine in nervous cases.

**PAGAN**, a heathen, gentile, or idolater; or one who adores false gods. See **MYTHOLOGY**.

**PAGANALIA**, certain festivals observed by the ancient Romans in the month of January. They were instituted by Servius Tullius, who appointed a certain number of villages (*pagi*), in each of which an altar was to be raised for annual sacrifices to their tutelar gods; at which all the inhabitants were to assist, and give presents in money, according to their sex and age, by which means the number of country-people was known. The servants upon this occasion offered cakes to Ceres and Tellus, to obtain plentiful harvests.

**PAGANELLUS**, in ichthyology. See **GOBIUS**.

**PAGANISM**, the religious worship and discipline of pagans; or, the adoration of idols and false gods. See **IDOLATRY** and **MYTHOLOGY**.

**PAGEANT**, a triumphal car, chariot, arch, or other like pompous decoration, variously adorned with colours, flags, &c. carried about in public shews, processions, &c.

**PAGOD**, or **PAGODA**, a name whereby the East-Indians call the temple in which they worship their gods.

**PAGOD**, or **PAGODA**, is also the name of a gold and silver coin, current in several parts of the East-Indies.

**PAIN**, is defined to be an uneasy sensation arising from a sudden and violent solution of the continuity, or some other accident in the nerves, membranes, vessels, muscles, &c. of the body; or, according to some, it consists in a motion of the organs of sense; and, according to others, it is an emotion of the soul occasioned by these organs.

**PAINTING**, the art of representing natural bodies, and giving them an appearance of life, by the turn of lines, and the degrees of colours.

Whoever would apply himself to painting, says Leonardo da Vinci, must in the first place learn perspective: this will enable him to dispose things in their proper places, and to give the due dimensions to each: having done this, he must learn to design; choosing for that purpose some able master, who at the same time may give him some insight into the colours of figures: he ought then to consult nature, to confirm himself in what he has already learnt; and, lastly, let him apply himself to the study and imitation of the greatest masters, in order to get a habit of reducing what he has learnt into practice.

To judge of the goodness of a painting, it is necessary to establish to ourselves a system of rules to be applied occasionally; and to assist the judgment herein, the following rules have been laid down: 1. The subject must be finely imagined, and, if possible, improved in the painter's hands; he must think well as an historian, poet, philosopher, or divine, and more especially as a painter, in making a wise use of all the advantages of his art, and in finding expedients to supply its defects. 2. The expression must be proper to the subject, and the characters of the persons: it must be strong, so that the dumb shew may be perfectly and readily understood: every part of the picture must contribute to this end; colours, animals, draperies, and especially the actions of the figures, and above all the airs of the heads. 3. There must be one principal light; and this, and all the subordinate ones, with the shadows and repotes, must make one entire and harmonious mass; the several parts must be well connected and contrasted, so as to render the whole as grate-  
ful

ful to the eye, as a good piece of musick to the ear. By this means the picture is not only more delightful, but better seen and comprehended. 4. The drawing must be just; nothing must be flat, lame, or ill proportioned; and these proportions should vary according to the characters of the persons drawn. 5. The colouring, whether gay or solid, must be natural, beautiful, and clean, and what the eye is delighted with, in shadows, as well as lights and middle tints; and whether the colours are laid on thick, or finely wrought, they must appear to be done by a light and accurate hand. Lastly, Nature must be the foundation that must be seen at the bottom; but nature must be raised and improved, not only from what is commonly seen, to what is but rarely met with, but even yet higher, from a judicious and beautiful idea in the painter's mind, so that grace and greatness may shine throughout more or less according to the subject.

Painting is of various kinds, according to the materials used, the matter upon which they are applied, and the manner of applying them; as painting in oil, in water-colours, fresco, &c.

**PAINTING in oil.** The whole secret of painting in oil consists in grinding the colours with nut oil, or linseed-oil; but the manner of working is very different from that in fresco, or in water, by reason the oil does not dry near so fast, which gives the painter an opportunity of touching and re touching all the parts of his figures as often as he pleases; which in the other methods of painting is a thing impracticable. The figures done in oil are also capable of more force and boldness; inasmuch that the black becomes blacker, when ground with oil, than with water; besides, all the colours mixing better together, makes the colouring the sweeter, more delicate and agreeable, and gives an union and tenderness to the whole, inimitable in any of the other manners.

Painting in oil is performed on canvas, on walls, wood, stone, and all sorts of metals. 1. Painting on cloth or canvas is done as follows: The canvas being stretched on a frame, give it a layer of size, or paste-water, and then go over it with a pumice-stone to smooth off the knots. By means of the size, the little threads and hairs are all laid close on the cloth, and the little holes filled up, so that no colour can pass through. When the cloth is dry, lay on oker in oil, which may be mixed with white-lead to make it dry the sooner. When dry, go over it again with the pumice-stone, to make it smooth. After this a second couch is sometimes applied, composed of white-lead and a little charcoal-black, to render the ground of an ash colour. Others prime the canvas in the following manner: They first smooth the canvas with a pumice-stone, size it over with a good size and a little honey, and let it stand to dry; after which they lay it over with whitening and size, mixed with a little honey: the use of the honey is to prevent it from cracking, peeling, and breaking out; on this they first draw the picture with a coal, and then lay on the colours. 2. Painting on walls: When the wall is dry, they give it two or three washes with boiling oil; till the plaster remains quite greasy, and will imbibe no more; upon this they lay drying colours, such as white-chalk, red-oker, or other chalks beaten pretty stiff. When this couch or layer is well dried, the subject or design is sketched out, and afterwards painted over, mixing a little varnish with their colours, to save the varnishing afterwards. In order the

better to fortify the wall against moisture, some cover it with a plaster of lime, marble-dust, or a cement made of beaten shives soaked in linseed-oil; and at last prepare a composition of green-pitch, mastic, and thick varnish boiled together, which they apply hot over the former plaster; and when dry, lay on the colours as before. Others, in fine, make their plaster with lime-mortar, tile-cement, and sand; and this being dry, they apply another of lime, cement, and iron scorix; which being well beaten, and incorporated with linseed-oil and whites of eggs, makes an excellent plaster. When this is dry, the colours are laid on as before. 3. In painting on wood, they usually give their ground a couch or layer of white tempered with size, and then proceed as in painting on walls. 4. In painting on stone or metals, it is not necessary to lay them over with size, but only to add a slight couch of colours before the design is drawn on it; nor even is this done on stones, where you would have the ground appear, as in certain marbles and agates of extraordinary colours.

All the colours used in fresco are good in oil, except white of lime and marble dust. Those chiefly used are white-lead, or ceruse, yellow and white masticot, orpiment, vermilion, lacca, blue and green ashes, verdigrease, indigo, smalt, black-lead, ivory-black, lamp-black, &c. As to oils, the best are those of linseed, walnuts, spike, and turpentine. The drying oils are nut-oil, boiled with litharge and sandarach, and otherwise with spirit of wine, mastic, and gum-lacca.

In the preparation of oil-colours, care must be taken that they be ground fine; that in putting them on a pallet, those which will not dry of themselves be mixed with drying oil, or other ingredients of a drying quality; and that the tinged colours be mixed in as small quantities as possible. As to the situation of the colours, the purest and strongest must be placed in the front of the piece, and the colouring varied according to the subject, time, and place. If the subject be grave, melancholy, or terrible, the general tint of the colouring must incline to brown and black, or red and gloomy; but it must be gay and pleasant, in subjects of joy and triumph.

**PALÆSTRA**, in Grecian antiquity, a public building, where the youth exercised themselves in wrestling, running, playing at quoits, &c.

**PALÆSTROPHYLAX**, was the director of the palæstra and the exercises performed there.

**St. PALAIS**, a town of France, in the province of Gascony, capital of the lower Navarre, situated in W. long. 1° 8', N. lat. 43° 23'.

**PALAMBOANG**, or **PALAMBANG**, the capital of a kingdom at the east end of the island of Java, in the East-Indies, situated on the straits of Bally, in E. long. 114°, S. lat. 7° 30'; and separated from the island of Bally by a narrow strait.

**PALAMEDIA**, in ornithology, a genus belonging to the order of grallæ. The bill is conical, the superior mandible being crooked; and the feet have three divided toes. There are two species, both natives of Brasil.

**PALARIA**, among the Romans, a kind of exercise, performed at a stake by the soldiers. The stake being fixed in the ground, and six feet high above it, the young undisciplined soldiers advanced against it, armed with a hurdle and cudgel, instead of a shield and sword, and went through all the rules of attack and defence, as if actually engaged

engaged with an adversary. Sometimes they stood at a distance, and attacked with missile weapons, at the same time using all the requisite motions for defending themselves, and warding off what might be thrown against them.

**PALATE**, in anatomy. See **ANATOMY**, p. 162, 303.

**PALATINATE**, a province, or signiory, possessed by a palatine.

**PALATINE**, or **COUNT PALATINE**, a title anciently given to all persons who had any office or employment in the prince's palace; but afterwards conferred on those delegated by princes to hold courts of justice in the provinces; and on such among the lords as had a palace, that is, a court of justice, in their own houses.

At present the word palatine is restrained to a prince of Germany, or a lord of Poland, possessed of a palatine.

**PALATO-SALPINGEUS**. See **ANATOMY**, p. 303.

**PALATO-STAPHYLINUS**, in anatomy. See **ANATOMY**, p. 303.

**PALE**, a little pointed stake or piece of wood, used in making inclosures, separations, &c. The pale was an instrument of punishment and execution among the ancient Romans, and still continues so among the Turks. Hence empaling, the passing a sharp pale up the fundament through the body.

**PALE**, in heraldry, one of the honourable ordinaries of an escutcheon; being the representation of a pale or stake placed upright, and comprehending the whole height of the coat from the top of the chief to the point. When the pale is single, it is to contain one third of the breadth of the shield. See **PLATE CXXXIV**. fig. 7.

**PALERMO**, the capital of the island of Sicily, situated on the north coast of that island, on a bay of the Mediterranean sea: in E. long. 13°, N. lat. 38° 30'.

**PALESTINE**, a part of Asiatic Turkey, situated between thirty-six and thirty-eight degrees of east longitude, and between thirty-one and thirty-four degrees of north latitude: it is bounded by Mount Libanus which divides it from Syria, on the north; by Mount Hermon, which separates it from Arabia Deserta, on the east; by the mountains of Seir and the Deserts of Arabia Petræa, on the south; and by the Mediterranean sea, on the west.

It was called Palestine, from the Philistines who inhabited the sea-coasts. It was also called Judæa, from Judah; and the Holy Land, from our Saviour's residence and sufferings in it; and it is called Canaan, and the Promised Land, in the scriptures.

It is 150 miles in length, and 80 in breadth; and in the time of Solomon it seems to have extended from the Mediterranean sea to the river Euphrates.

**PALESTRINA**, a city of Italy, in the pope's territory and Campania of Rome, situated thirty miles east of Rome.

**PALIMBAM**, a town on the island of Sumatra, in the East-Indies, situated in E. long. 103°, S. lat. 3°.

**PALINDROMUS**, a verse or sentence which runs the same when read either backwards or forwards; such is the verse,

*Roma tibi subito motibus ibit amor.*

**PALING**, a sort of fencing for fruit-trees planted in fields, wherein three small posts are erected at a foot and a half distance one from another, and near the top nailed to each other with cross-bars.

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**PALINGENESIA**, among divines, signifies the same with regeneration.

Among chemists, it denotes the producing a body from its principles.

**PALINODY**, a discourse contrary to a preceding one: hence the phrase *palinodiam canere* was taken for a recantation.

**PALISADE**, in fortification, an inclosure of stakes or piles driven into the ground, each six or seven inches square; and eight feet long, three whereof are hid under ground.

**PALISSE**, in heraldry, a bearing like a range of palisades before a fortification, represented on a fesse, rising up a considerable height, and pointed a-top, with the field appearing between them. See **PLATE CXXXIV**. fig. 8.

**PALIURUS**, in botany. See **RHAMNUS**.

**PALL**, in heraldry, denotes a kind of cross representing the pallium, or archiepiscopal ornament sent from Rome to the Metropolitans. See **PLATE CXXXIV**. fig. 9.

**PALLA**, in Roman antiquity, a mantle which women wore over the gown called stola. It was borne on the left shoulder; whence passing to the other side, under the right arm, the two ends were bound under the left arm, leaving the breast and arm quite bare.

**PALLADIUM**, in antiquity, a statue of the goddess Pallas, supposed to have dropped down from heaven; preserved in Troy, whereon the fate of that city is said to have depended.

**PALLET**, among painters, a little oval table, or piece of wood, or ivory, very thin and smooth; on and round which the painters place the several colours they have occasion for, to be ready for the pencil. The middle serves to mix the colours on, and to make the tints required in the work. It has no handle, but instead thereof, a hole at one end to put the thumb through to hold it.

**PALLET**, in heraldry, is nothing but a small pale, consisting of one half of it in breadth, and therefore there are sometimes several of them upon one shield.

**PALLET**, in ship-building, is a room within the hold, closely parted from it, in which by laying some pigs of lead, &c. a ship may be sufficiently ballasted, without losing room in the hold; which, therefore, will serve for the stowing the more goods.

**PALLIATION**, or a **PALLIATIVE CURE**, in medicine, is when, in desperate and incurable diseases, after predicting the fatal event, the physician prescribes some remedies for mitigating the pain or some other urgent symptoms, as in ulcerated cancers, or cancerous fistulas, and the like.

**PALLIUM**, or **PALL**, an archiepiscopal vestment, of white woollen cloth, about the breadth of a border, made round, and thrown over the shoulders.

**PALM-SUNDAY**, in the Christian church, the Sunday next before Easter; being so called in memory of our Saviour's triumphal entry into Jerusalem when the multitude that attended him strewed palm-branches in his way.

**PALM-TREE**, in botany. See **PHOENIX**.

**PALMA ISLE**, one of the Canary-islands, sixty miles north-west of Teneriff.

**PALMARIS**, in anatomy. See **ANATOMY**. p. 199.

**PALMATED**, something resembling the shape of the hand: thus we say palmated leaves, roots, stones, &c.

**PALMPEDES**, among ornithologists, the same with web-footed birds.

- PALMISTRY**, a kind of divination, or rather a deceitful art practised by gypsies, who pretend to foretell events by locking upon the lines and marks of the hand.
- PALMYRA**, the ruins of a magnificent city, in the province of Syria, two hundred miles south-east of Aleppo.
- PALOS**, a port-town of Spain, situated on the bay of Cadiz: W. long.  $7^{\circ} 15'$ , N. lat.  $37^{\circ}$ .
- PALPABLE**, something perceivable by the senses, particularly that of feeling.
- PALPITATION**, a spastic contraction of the heart, when it leaps and beats violently.
- PALSY**, in medicine. See **MEDICINE**, p. 97.
- PALUDAMENTUM**, in Roman antiquity, a habit that differed in little from the chlamys, except that this last belonged chiefly to the lower class of people. See **CHLAMYS**.
- PALUMBUS**. See **COLUMBA**.
- PALY**, or **PALÉ**, in heraldry, is when the shield is divided into four or more equal parts, by perpendicular lines falling from the top to the bottom. See Plate **CXXXIV**. fig. 1c.
- Paly bendy is when the escutcheon is divided by perpendicular lines, which is paly; and also by diagonals, which is called bendy. See the article **BENDY**.
- PAMPELUNA**, the capital of Spanish Navarre, is the see of a bishop, and an university: W. long.  $1^{\circ} 30'$ , N. lat.  $43^{\circ} 15'$ .
- PANACEA**, among physicians, denotes an universal medicine, or a remedy for all diseases; a thing impossible to be obtained.
- PANADA**, a diet consisting of bread boiled in water to the consistence of a pulp, and sweetened with a little sugar.
- PANAMA**, the capital city of the province of Darien, in South America, where the treasures of gold and silver, and the other rich merchandize of Peru, are lodged in magazines till they are sent to Europe; W. long.  $82^{\circ}$ , N. lat.  $9^{\circ}$ .
- PANARO**, a river of Italy, which rising in the Apennine mountains, on the confines of Tuscany, divides Modena from Romania, and then running through the Ferrarese falls into the Gulph of Venice.
- PANATHENÆA**, in Grecian antiquity, an ancient Athenian festival, in honour of Minerva, who was the protectress of Athens, and called Athena.
- PANAX**, in botany, a genus of the polygamia dicæcia class. The calix of the hermaphrodite has five teeth, and the corolla five petals; there are five stamina, and two styli; and the berry contains two seeds. The calix of the male is entire; the corolla has five petals; and there are five stamina. The species are three, none of them natives of Britain.
- PANAY**, the capital of the isle of Panay, one of the Philippine islands: E. long.  $119^{\circ}$ , and N. lat.  $11^{\circ}$ .
- PANCARPUS**, in Roman antiquity, a kind of shew which the Roman emperors frequently exhibited to the people. In this spectacle, the circus being set all over with large trees, represented a forest, into which the beasts being let from the dens under the ground, the people, at a sign given by the emperor, pursued, shot, cut in pieces, and killed all they could lay hold of, which they afterwards carried away, to regale upon at home. The beasts usually given on these occasions were boars, deer, oxen, and sheep.
- PANCHYMAGOGUE**, in pharmacy, a name given to some cathartic extracts.
- PANCRATIUM**, among the ancients, a kind of exercise, which consisted of wrestling and boxing. In these contests it was customary for the weaker party, when he found himself pressed by his adversary, to fall down, and fight rolling on the ground.
- PANCRATIUM**, in botany, a genus of the hexandria monogynia class. It has six petals, and a nectarium divided into twelve segments, and the stamina lie upon the nectarium. There are seven species, none of them natives of Britain.
- PANCREAS**, in anatomy. See **ANATOMY**, p. 265.
- PANDECTS**, in the civil law, collections made by Justinian's order, of five hundred and thirty-four decisions of the ancient lawyers, on so many questions occurring in the civil law; to which that emperor gave the force and authority of law, by an epistle prefixed to them. The pandects consist of fifty books, and make the first part of the body of the civil law.
- PANDICULATION**, a stretching, or that violent and tensive motion of the solids, which usually accompanies the act of yawning.
- PANEGYRIC**, an oration in praise of some extraordinary thing, person, or virtue.
- Panegyrics were anciently made in the public and solemn assemblies of the Greeks, either at their games, their feasts, or religious meetings.
- PANEGYRICUM**, in church-history, an ecclesiastical book, used by the Greek church, containing the panegyric orations of various authors on the solemnities of Jesus Christ and the saints.
- PANGONIA**, in natural history, the name of a genus of crystal, consisting of such as are composed of many angles.
- PANIC**, denotes an ill-grounded terror or fright.
- PANICLE**, in botany, denotes a soft woolly beard, on which the seeds of some plants, as millet, reeds, &c. hang.
- PANICUM**, in botany, a genus of the triandria digynia class. The calix consists of three valves, the inmost of which is least. There are 28 species, four of which are natives of Britain, viz. the viride, or green panic-grass; the crassigalli, or loose panic-grass; the sanguinale, or cock's-foot panic-grass; and the dactylon, or creeping panic-grass.
- PANNEL**, in law, signifies the prisoner at the bar, or person who takes his trial before the court of judicatory, for some crime. See **LAW**, Tit. xxxiii. 47.
- PANNELS of a saddle**, are two cushions or bolsters, filled with cow's, deer's, or horse-hair, and placed under the saddle, on each side, to prevent the bows and bands from galling the horse.
- PANNICULUS CARNOSUS**, in comparative anatomy, a robust fleshy tunic, situated in beasts, between the tunic and the fat; by means of which they can move their skin in whole or part: it is altogether wanting in mankind.
- PANORPA**, the **SCORPION-FLY**, in zoology, a genus of insects belonging to the order of neuroptera. The rostrum is horny and cylindrical; there are two pappi, and three stemonata; the feelers are longer than the thorax; and the tail of the male is furnished with a forceps. There are four species, distinguished by the colour and shape of their wings.

**PANTALOON**, a sort of garment, consisting of breeches and stockings all of one piece; said to have been first introduced by the Venetians.

**PANTHEON**, in Roman antiquity, a temple of a circular form, dedicated to all the gods: It was built by Agrippa, son-in-law to Augustus; but is now converted into a church, and dedicated to the Virgin and all the martyrs.

**PANTHER**, in zoology. See **LEO**.

**PANTOMIME**, a person who imitates all sorts of actions and characters, by mere gestures, without speaking a word.

**PANUCO**, a city of Mexico, situated at the mouth of a river of the same name, and which falls into the gulph of Mexico: W. long. 103°, and N. lat. 23°.

**PAPAYER**, in botany, a genus of the polyandria monogynia class. The corolla consists of four petals, and the calix of two leaves. There are nine species, six of them natives of Britain, *viz.* the hybridum, or round rough-headed poppy; the cambricum, or yellow poppy; the fominiferum, or wild poppy; the orgemone, or long rough-headed poppy; the rhæas, or red corn-poppy; and the dubium, or long smooth-headed poppy. For the medicinal properties of poppy, see **OPIMUM**.

**PAPENHEIM**, a town of Franconia, in Germany, subject to its own count: E. long. 11°, N. lat. 48° 55'.

**PAPER**, sheets of a thin matter, made of some vegetable substance.

The materials on which mankind have, in different ages, contrived to write their sentiments, have been extremely various; in the early ages they made use of stones, and tables of wood, wax, ivory, &c. See **BOOK**.

Paper, with regard to the manner of making it, and the materials employed therein, is reducible to several kinds; as Egyptian paper, made of the rush papyrus; bark-paper, made of the inner rind of several trees; cotton paper; incombustible paper; and European paper, made of linen rags.

Egyptian paper was principally used among the ancients; being made of the papyrus, or biblus, a species of rush which grew on the banks of the Nile. In making it into paper, they began with lopping off the two extremes of the plant, the head and the root; the remaining part, which was the stem, they cut lengthwise into two nearly equal parts, and from each of these they stripped the scaly pellicles of which it consisted. The innermost of these pellicles were looked on as the best, and that nearest the rind as the worst: they were therefore kept apart, and made to constitute two different sorts of paper. As the pellicles were taken off, they extended them on a table, laying them over each other transversely, so as that the fibres made right angles: in this state they were glued together by the muddy waters of the Nile; or, when those were not to be had, with paste made of the finest wheat-flour mixed with hot water and a sprinkling of vinegar. The pellicles were next pressed to get out the water, then dried, and lastly flattened and smoothed by beating them with a mallet: this was the Egyptian paper, which was sometimes farther polished by rubbing it with a glass-ball, or the like.

Bark-paper was only the inner whitish rind, inclosed between the bark and the wood of several trees, as the maple, plane, beech, and elm, but especially the tilia, or linden-tree, which was that mostly used for this purpose.

On this stripped off, flattened, and dried, the ancients wrote books, several of which are said to be still extant.

Chinese paper is of various kinds. Some is made of the rinds or barks of trees, especially the mulberry-tree and elm, but chiefly of the bambu and cotton-tree. In fact, almost each province has its several paper. The preparations of paper made of the barks of trees, may be inflamed in that of the bambu, which is a tree of the cane or reed kind. The second skin of the bark, which is soft and white, is ordinarily made use of for paper: this is beat in fair water to a pulp, which they take up in large moulds, so that some sheets are above twelve feet in length; they are completed, by dipping them sheet by sheet, in alum-water, which serves instead of the size among us, and not only hinders the paper from imbibing the ink, but makes it look as if varnished over. This paper is white, soft, and close, without the least roughness; though it cracks more easily than European paper, is very subject to be eaten by the worms, and its thinness makes it liable to be soon worn out.

Cotton-paper is a sort of paper which has been in use upwards of six hundred years. In the French king's library are manuscripts on this paper, which appear to be of the Xth century; and from the XIIth century, cotton manuscripts are more frequent than parchment ones. Cotton-paper is still made in the East-Indies, by beating cotton rags to a pulp.

Linen or European paper appears to have been first introduced among us towards the beginning of the XIVth century; but by whom this valuable commodity was invented, is not known. The method of making paper of linen or hempen-rags, is as follows. The linen-rags being carried to the mill, are first sorted, then washed very clean in puncheons, whose sides are grated with strong wires, and the bottoms bored full of holes. After this they are fermented, by laying them in heaps close covered with sacking, till they sweat and rot, which is commonly done in four or five days. When duly fermented, they are twisted into handfuls, cut small, and thrown into oval mortars, made of well-seasoned oak, about half a yard deep, with an iron-plate at bottom, an-inch thick, eight inches broad, and thirty long; in the middle is a washing-block, grooved, with five holes in it, and a piece of hair-sieve fastened on the inside; this keeps the hammers from touching it, and prevents any thing going out except the foul water. These mortars are continually supplied with water, by little troughs from a cistern, fed by buckets fixed to the several floats of a great wheel, which raises the wooden hammers for pounding the rags in the mortars. When the rags are beaten to a certain degree, called the first stuff, the pulp is removed into boxes, made like corn-chandlers bins, with the bottom-board afloat, and a little separation on the front for the water to drain away. The pulp of the rags being in, they take away as many of the front boards as are needful, and press the mass hard down with their hands; the next day they put on another board, and add more pulp, till the box is full; and here it remains mellowing a week, more or less, according to the weather. After this, the stuff is again put into clean mortars, and is beaten afresh, and removed into boxes, as before, in which state it is called the second stuff. The mass is beat a third time, till some of it being mixed with fair water, and brewed to and fro, appears.

appears like flour and water, without any lumps in it: it is then fit for the pit-mortar, where it is perfectly dissolved, and is then carried to the vat, to be formed into sheets of paper. But lately, instead of pounding the rags to a pulp with large hammers, as above, they make use of an engine, which performs the work in much less time. This engine consists of a round solid piece of wood, into which are fastened several long pieces of steel, ground very sharp. This is placed in a large trough with the rags, and a sufficient quantity of water. At the bottom of the trough is a plate with steel bars, ground sharp like the former; and the engine being carried round with prodigious velocity, reduces the rags to a pulp in a very short time. It must be observed, that the motion of the engine causes the water in the trough to circulate, and by that means constantly returns the stuff to the engine. The trough is constantly fed with clean water at one end, while the dirty water from the rags is carried off at the other, through a hole, defended with wire gratings. in order to hinder the pulp from going out with the dirty water.

When the stuff is sufficiently prepared as above, it is carried to the vat, and mixed with a proper quantity of water, which they call priming the vat. The vat is rightly primed, when the liquor has such a proportion of the pulp, as that the mould, on being dipped into it, will just take up enough to make a sheet of paper of the thickness required. The mould is a kind of sieve exactly of the size of the paper to be made, and about an inch deep, the bottom being formed of fine brass wire, guarded underneath with sticks, to prevent it bagging down, and to keep it horizontal; and further, to strengthen the bottom, there are large wires placed in parallel lines, at equal distances, which form those lines visible in all white paper when held up to the light: the mark of the paper is also made in this bottom, by interweaving a large wire in any particular form. This mould the maker dips into the liquor, and gives it a shake as he takes it out, to clear the water from the pulp. He then slides it along a groove to the coucher, who turns out the sheet upon a felt laid on a plank, and lays another felt on it; and returns the mould to the maker, who by this time has prepared a second sheet in another mould: and thus they proceed, laying alternately a sheet and a felt, till they have made six quires of paper, which is called a post; and this they do, with such swiftness, that, in many sorts of paper, two men make twenty posts or more in a day. A post of paper being made, either the maker or coucher whistles; on which four or five men advance, one of whom draws it under the press, and the rest press it with great force, till all the water is squeezed from it; after which it is separated sheet by sheet from the felts, and laid regularly one sheet upon another; and having undergone a second pressing, it is hung up to dry. When sufficiently dried, it is taken off the lines, rubbed smooth with the hands, and laid by till sized, which is the next operation. For this they chuse a fine temperate day; and having boiled a proper quantity of clean parchment, or vellum shavings, in water, till it comes to a size, they prepare a fine cloth, on which they strew a due proportion of white vitriol and rock-alum finely powdered, and strain the size through it into a large tub; in which they dip as much paper at once as they can conveniently

hold, and with a quick motion give every sheet its share of the size, which must be as hot as the hand can well bear it. After this, the paper is pressed, hung up sheet by sheet to dry; and being taken down, is sorted, and what is only fit for outside-quires laid by themselves: it is then told into quires, which are folded and pressed. The broken sheets are commonly put together, and two of the worst quires are placed on the outside of every ream or bundle: and being tied up in wrappers, made of the settling of the vat, it is fit for sale.

Paper is of various kinds, and used for various purposes: with regard to colour, it is principally distinguished into white, blue, and brown; and with regard to its dimensions, into atlas, elephant, imperial, super-royal, royal, medium, demy, crown, foolscap, and pot-paper.

PAPER-OFFICE, an office in the palace of Whitehall, in which all the public writings, matters of state and council, proclamations, letters, intelligences, negotiations abroad, and generally all dispatches that pass through the offices of the secretaries of state, are lodged, by way of library.

PAPHLAGONIA, an ancient province of the lesser Asia, situated on the Euxine-sea, now part of the province of Amasia in Turkey.

PAPHOS, once an elegant city at the west end of the island of Cyprus; but the little town of Baffo is now all that remains of it.

PAPILIO, the BUTTERFLY, in zoology, a genus of insects belonging to the order of lepidoptera. It has four wings, imbricated with a kind of downy scales; the tongue is convoluted in a spiral form; and the body is hairy. There are 273 species, principally distinguished by the colour of their wings.

PAPILIONACEOUS, among botanists, an appellation given to the flowers of plants belonging principally to the diadelphia class; from their resembling the figure of a butterfly.

PAPOUS, or NEW GUINEA, a large continent in the Pacific ocean, a little south of the equator; situated east of the Spice islands, in 130° east long. but how far it extends farther to the eastward or southward, is uncertain.

PAPPUS, in botany, a soft downy substance, that grows on the seeds of certain plants, as thistles, hawkweed, &c. serving to scatter and buoy them up in the air.

PAR, in commerce, signifies any two things equal in value. See COMMERCE.

PARABLE, a fable, or allegorical instruction, founded on something real or apparent in nature or history, from which a moral is drawn, by comparing it with something in which the people are more immediately concerned; such are the parables of Dives and Lazarus, of the Prodigal Son, of the Ten Virgins, &c.

PARABOLA. See CONIC SECTIONS.

PARACENTESIS, an operation in surgery, commonly called tapping. See SURGERY.

PARACLET, the COMFORTER, a name given to the Holy Ghost.

PARADISEA, in ornithology, a genus belonging to the order of picæ. The beak is covered with a belt or collar of downy feathers at the base; and the feathers on the sides are very long. There are three species, viz. 1. The apoda, has the feathers on the sides longer than the body, and two long bristly feathers in the tail. It is the greater bird of paradise, and feeds upon butterflies. They

are

are found in large flocks in the Molucca islands. 2. The regia, has two intermediate prime tail-feathers like threads and feathery at the points. It is found in Amboina. 3. The triftis, has a naked triangular spot behind the eyes; and the head and neck are of a dusky colour. It is a native of the Philippine isles, and feeds upon grafs-hoppers and other insects.

PARADISE, a term principally used for the garden of Eden, in which Adam and Eve were placed immediately upon their creation.

As to this terrestrial paradise, there have been many inquiries about its situation. It has been placed in the third heaven, in the orb of the moon, in the moon itself, in the middle region of the air, above the earth, under the earth, in the place possessed by the Caspian sea, and under the arctic pole. The learned Huetius places it upon the river that is produced by the conjunction of the Tigris and Euphrates, now called the river of the Arabs, between this conjunction and the division made by the same river before it falls into the Persian sea. Other geographers have placed it in Armenia, between the sources of the Tigris, the Euphrates, the Araxis, and the Phasis, which they suppose to be the four rivers described by Moses.

The celestial paradise is that place of pure and refined delight, in which the souls of the blessed enjoy everlasting happiness.

*Bird of PARADISE.* See PARADISEA.

PARADOX, in philosophy, a proposition seemingly absurd, as being contrary to some received opinion, but yet true in fact.

No science abounds more with paradoxes than geometry: thus, that a right line should continually approach to the hyperbola, and yet never reach it, is a true paradox; and in the same manner, a spiral may continually approach to a point, and yet not reach it, in any number of revolutions, however great.

PARÆA, in zoology. See COLUBER.

PARAGOGE, in grammar, a figure whereby a letter or syllable is added to the end of a word; as *med*, for *me*; *dicièr*, for *dici*, &c.

PARAGUAY, or LA PLATA, a province of South America, subject to Spain, lies between  $12^{\circ}$  and  $37^{\circ}$  S. lat. and between  $50^{\circ}$  and  $75^{\circ}$  W. long.

PARALIPOMENA, in matters of literature, denotes a supplement of things omitted in a preceding work.

PARALLACTIC, in general, something relating to the parallax of heavenly bodies. See PARALLAX.

PARALLAX, in astronomy. See ASTRONOMY, p. 452.

PARALLEL, in geometry, an appellation given to lines, surfaces, and bodies every where equidistant from each other. See GEOMETRY.

PARALLELS of latitude, in astronomy, are lesser circles of the sphere parallel to the ecliptic, imagined to pass through every degree and minute of the colures.

PARALLELS of altitude, or ALMUCANTARS, are circles parallel to the horizon, imagined to pass through every degree and minute of the meridian between the horizon and zenith, having their poles in the zenith.

PARALLELS of declination, in astronomy, are the same with parallels of latitude in geography.

PARALLEL SPHERE, that situation of the sphere, wherein

the equator coincides with the horizon, and the poles with the zenith and nadir.

PARALLEL SAILING. See NAVIGATION.

PARALLELOPIPED, in geometry, a regular solid comprehended under six parallelograms, the opposite ones whereof are similar, parallel, and equal.

PARALLELOGRAM, in geometry, a quadrilateral right-lined figure, whose opposite sides are parallel and equal to each other.

PARALLELOPIPEDIA, in natural history, the name of a genus of spars, thus called, because regularly of a paralleloped form.

They are pellucid crystalline spars externally of a determinate and regular figure; always found loose, detached, and separate from all other bodies, and in form of an oblique paralleloped, with six parallelogram sides and eight solid angles, easily fissile either in an horizontal or perpendicular direction, being composed of numbers of thin plates, and those of very elegantly and regularly arranged bodies, each of the same form with the whole mass, except that they are thinner in proportion to their horizontal planes; and naturally fall into these and no other figures, on being broken with a slight blow.

PARALOGISM, in logic, a false reasoning, or a fault committed in demonstration, when a consequence is drawn from principles that are false, or, though true, are not proved; or when a proposition is passed over that should have been proved by the way.

PARALYSIS, the PALSY. See MEDICINE, p. 97.

PARAMECIA, in natural history, a name given to such animalcules as have no visible limbs or tails, and are of an irregularly oblong figure.

PARAMETER, in conic sections, a constant line, otherwise called latus rectum. See CONIC SECTIONS.

PARAMOUNT, in law, signifies the supreme lord of the fee.

PARANYMPH, among the ancients, the person who waited on the bridegroom, and directed the nuptial solemnities; called also pronubus, and auspex, because the ceremonies began by taking auspicia. As the paranymp officiated only on the part of the bridegroom, a woman called pronuba officiated on the part of the bride.

PARAPET, in fortification, an elevation of earth designed for covering the soldiers from the enemies cannon or small shot. See FORTIFICATION.

PARAPHERNAL goods in Scots law. See LAW, Tit. vi. 8.

PARAPHIMOSIS, in medicine, a disorder in the penis, wherein the prepuce is shrunk, and withdrawn behind the glans, so as not to be capable of being brought to cover the same; which generally happens in venereal disorders. See MEDICINE.

PARAPHRASE, an explanation of some text, in clearer and more ample terms, whereby is supplied what the author might have said or thought on the subject; such are esteemed Erasmus's paraphrase on the New Testament, the Chaldee paraphrase on the Pentateuch, &c.

PARAPHRENITIS, in medicine, an inflammation of the diaphragm. See MEDICINE.

PARAPHROSYNE, a word used by medical writers to express a delirium, or an alienation of mind in fevers, or from whatever cause.

PARAPLEGIA, a species of palsy. See MEDICINE.

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PARASELENE, in physiology, a mock moon, a meteor, or phenomenon, encompassing, or adjacent to, the moon, in form of a luminous ring; wherein are sometimes observed one, sometimes two, apparent images of the moon.

PARASITE, among the Greeks, was originally a very respectable title; the parasites being a kind of priests, at least ministers, of the gods, in the same manner as the Epulones were at Rome. They took care of the sacred corn, or the corn destined for the service of the temples, and the gods, viz. sacrifices, feasts; &c. they had even the intendance over sacrifices, and took care that they were duly performed. At Athens, there was a kind of college of twelve parasites; each people of Attica furnishing one, who was always chosen out of the best families. Polybius adds, that a parasite was also an honourable title among the ancient Gauls, and was given to their poets; but of late it has been made a term of reproach, and used for a flatterer and mean dependant.

PARASITES, or PARASITICAL PLANTS, in botany, such plants as are produced out of the trunk or branches of other plants, from whence they receive their nourishment, and will not grow upon the ground, as the mistletoe, &c.

PARASTATÆ, in anatomy. See ANATOMY, p. 270.

PARASYNANCHE, in medicine, a kind of angina, or quinsey. See MEDICINE, p. 84.

PARATHENAR, in anatomy. See ANAT. p. 212.

PARBUNCLE, in a ship, the name of a rope almost like a pair of slings: it is seized both ends together, and then put double about any heavy thing that is to be hoisted in or out of the ship; having the hook of the runner hitched into it, to hoist it up by.

PARCÆ, in the heathen mythology, goddesses, who were supposed to preside over the accidents and events, and to determine the date or period, of human life. See MYTHOLOGY.

PARCHMENT, the skins of sheep or goats prepared after such a manner as to render it proper for writing upon, covering books, &c.

The manufacture of parchment is begun by the skinner, and finished by the parchment-maker:

The skin having been stripped of its wool, and placed in the lime pit, the skinner stretches it on a kind of frame, and pares off the flesh with an iron instrument: this done, it is moistened with a rag; and powdered chalk being spread over it, the skinner takes a large pumice-stone, flat at bottom, and rubs over the skin, and thus scowers off the flesh: he then goes over it again with the iron instrument, moistens it as before, and rubs it again with the pumice-stone without any chalk underneath: this smooths and softens the flesh-side very considerably. He then drains it again, by passing over it the iron instrument as before. The flesh-side being thus drained, by scraping off the moisture, he in the same manner passes the iron over the wool or hair side: then stretches it tight on a frame, and scrapes the flesh side again: this finishes its draining; and the more it is drained, the whiter it becomes. The skinner now throws on more chalk, sweeping it over with a piece of lamb skin that has the wool on; and this smooths it still farther. It is now left to dry; and when dried, taken off the frame, by cutting it

all round. The skin, thus far prepared by the skinner, is taken out of his hands by the parchment-maker; who first, while it is dry, pares it on a summer (which is a calf-skin stretched in a frame) with a sharper instrument than that used by the skinner, and, working with the arm from the top to the bottom of the skin, takes away about one half of its thickness. The skin, thus equally pared on the flesh-side, is again rendered smooth, by being rubbed with the pumice-stone on a bench covered with a sack stuffed with flocks, which leaves the parchment in a condition fit for writing upon. The parings thus taken off the leather, are used in making glue, size &c.

What is called vellum, is only parchment made of the skins of abortives, or at least sucking calves. This has a much finer grain, and is whiter and smoother than parchment; but is prepared in the same manner, except its not being passed through the lime-pit.

PARDALUS. See LEO.

PAREGORICS in pharmacy, medicines that assuage pain, otherwise called anodynes.

PAREIRA BRAVA, in the materia medica, a kind of oblong and large root, brought from the Brasils.

It is certainly a diuretic of no mean character, and has done great service in nephritic cases; and in pleurisies and quinsies it has been attended with more success than almost any medicine we know of singly.

PARELCON, in grammar, a figure by which a word or syllable is added to the end of another.

PAREMBOLE, in rhetoric, a figure wherein something relating to the subject is inserted in the middle of a period. All the differences between the parembole and parenthesis, according to Vossius, is, that the former relates to the subject in hand, whereas the latter is foreign to it.

PARENCHYMA, in anatomy, a term introduced by Erasistratus, signifying all that substance which is contained in the interstices betwixt the blood-vessels of the viscera, which he imagined to be extravasated and concentered blood.

PARENCHYMA of plants. Grew applies the term parenchyma to the pith or pulp, or that inner part of a fruit or plant through which the juice is supposed to be distributed. See AGRICULTURE.

PARENT, a term of relation applicable to those from whom we immediately receive our being.

PARENTALIA, in antiquity, funeral obsequies, or the last duties paid by children to their deceased parents.

PARENTHESIS, in grammar, certain intercalary words, inserted in a discourse, which interrupt the sense, or thread, but seem necessary for the better understanding of the subject.

PARENZO, or PIRENZO, a port-town of Istria, in the territory of Venice, situated on a bay of the gulph of Venice, twenty-five miles south of Cabo de Istria.

PAREISIS, in medicine, is defined to be a palsy of the bladder, wherein the urine is either suppressed, or discharged involuntarily.

PARETONIUM, in natural history, the name of an earth anciently found on the shores of Egypt, Cyrene, and the island of Crete, and used by the ancients in painting.

PARGET, in natural history, a name given to several kinds of gypsum, or plaster-stone.

PARGETING, in building, is used for the plastering of walls, and sometimes for plaster itself.

PAR-

**PARHELIUM**, or **PARHELION**, in physiology, a mock sun, or meteor, in form of a very bright light, appearing on one side of the sun.

The parhelia are formed by the reflection of the sun's beams on a cloud properly posited. They usually accompany the coronæ, or luminous circles, and are placed in the same circumference and at the same height. Their colours resemble that of the rainbow, the red and yellow are on the side towards the sun, and the blue and violet on the other. There are coronæ sometimes seen without parhelia, and *vice versa*.

Parhelia are double, triple, &c. and in 1629 a parhelia of five suns was seen at Rome, and in 1666 another at Arles of six.

M. Mariotte accounts for parhelia from an infinity of little particles of ice floating in the air, that multiply the image of the sun by refraction or reflection; and by a geometrical calculus he has determined the precise figure of these little icicles, their situation in the air, and the size of the coronæ of circles which accompany the parhelia, and the colours wherewith they are painted.

**PARIA**, a lake of Peru, in South America, in the province of Los Charcas, situated in 67° W. long. and 22° S. lat.

**PARIETALIA OSSA**, in anatomy. See **ANATOMY**, p. 154.

**PARIETARIA**, in botany, a genus of the polygamia monœcia class. The calix, both in the female and hermaphrodite, consists of four segments; none of them have any corolla; the hermaphrodite has four stamina; and both have one stylus, and one long seed. There are six species, only one of them, *viz.* the officinalis, or pellitory of the wall, is a native of Britain. It is esteemed a cooling and abstergent.

**PARIS**, in botany, a genus of the oscandria trigynia class. The calix consists of four leaves, and the corolla of four narrow petals; and the berry has four cells. There is but one species, *viz.* the quadrifolia, herb-paris, or true-love, a native of Britain.

**PARIS**, in geography, the metropolis of the kingdom of France, and of the principality or government of the isle of France, situated in E. long. 2° 25', N. lat 48° 50', two hundred miles south-east of London, six hundred and eighty north-east of Madrid, five hundred and fifty west of Vienna, one thousand three hundred north-west of Constantinople, and seven hundred north-west of Rome.

**PARISH**, the precinct of a parochial church, or a circuit of ground inhabited by people who belong to one church and are under the particular charge of its minister.

**PARK**, a large inclosure privileged for wild beasts of chase, either by prescription or the king's grant.

**PARKINSONIA**, in botany, a genus of the decandria monogynia class. The calix consists of four segments, and the corolla of four oval petals, the lowest being kidney-shaped; it has no stylus; and the pod is cylindrical.

**PARLEY**, a conference with an enemy. Hence to beat or sound a parley, is to give a signal for holding such a conference by beat of drum or sound of trumpet.

**PARLIAMENT**, is the grand assembly of the three states of this kingdom, summoned together, by the king's authority, to consult of matters relating to the public welfare, and particularly to enact and repeal laws. It consists of the king, the lords (spiritual and temporal), and

the commons, and is at once the seat of the legislative authority, and the highest court of justice in Great-Britain. In the house of lords, criminal causes are tried on the impeachment of the commons; and this house has an original jurisdiction for the trial of peers upon indictments found by a grand jury; the lords likewise try such causes as come thither on appeals from the court of chancery, and all their decrees are as judgments. The house of commons examine the right of elections; regulate disputes concerning them; may expel their own members, and commit them to prison. They are the grand inquest of the nation; and present public grievances or delinquents to the king and lords, in order to their being punished. In short, they are the representatives of all the commons in the kingdom; and in them their constituents have placed the highest confidence, by investing them with the power of making laws, and entrusting them with all their liberties and privileges.

Originally, new parliaments were called every year; but by degrees their term grew longer. In the reign of king Charles II. they were held a long time, with great interruptions between: but both methods were found of such ill consequence, that, in the beginning of the reign of king William III. an act was passed, by which the term of all parliaments was restrained to three sessions, or three years; this was hence called the triennial act: but since that time, from other views, the period of parliaments has been lengthened to seven years. A parliament is called by the king's writ or letter directed to each lord, commanding him to appear; and by other writs, directed to the sheriffs of each county, to summon the people to elect two knights for each county, and one or two burgesses for each borough. The number of the members in the house of lords is uncertain, as increasing at the king's pleasure. The members of the house of commons, when full, are five hundred and fifty-three; *viz.* ninety-two knights of the shires; fifty-two deputies for twenty-five cities, London having four; sixteen for the eight cinque-ports; two for each university; three hundred and thirty-two for an hundred and eighty boroughs; twelve for the boroughs in Wales, and forty-five members for Scotland. If three hundred of these members are met, it is reckoned a full house; and forty may compose a house for the dispatch of business.

Upon the holding of a parliament, the king, the first day, sits in the upper-house, under a canopy, with the crown on his head, and dressed in his royal robes; and there, by himself, or the lord chancellor, declares the reasons of their meeting, in the presence of both the lords and commons; and then the commons are required to chuse a speaker, who is presented to the king, and being approved by his majesty, the business of the parliament goes on.

The lords and commons sit each in a distinct apartment: in the house of lords, the princes of the blood sit by themselves on the sides of the throne; at the wall, on the king's right hand, the two archbishops sit by themselves on a form. Below them, the bishops of London, Durham, and Winchester; and all the other bishops, sit according to the priority of their consecration. On the king's left hand the lord-treasurer, lord president, and lord privy-seal, sit upon forms above all dukes, except the royal blood; then the dukes, marquises, and earls, according,

according to their creation. Across the room are wool-facks, continued from an ancient custom; and the chancellor, or keeper, being of course the speaker of the house of lords, sits on the first wool-fack before the throne, with the great seal or mace lying by him; below these are forms for the viscounts and barons. On the other wool facks are seated the judges, masters in chancery, and king's council, who are only to give their advice in points of law: but they all stand up till the king gives them leave to sit. The commons sit promiscuously; only the speaker has a chair at the upper end of the house, and the clerk and his assistant sit at a table near him. Before any business is done, all the members of the house of commons take the oaths of allegiance and supremacy, &c. and subscribe their opinions against transubstantiation, &c. and if any member of that house votes, or sits there during any debate, after the speaker is chosen, without having first taken these oaths, between the hours of nine and four, in a full house, he is adjudged a Popish recusant convict, and incapable of any office, and forfeits five hundred pounds. The same test the lords too, though they do not take the oaths, are obliged to comply with. When the parliament is thus met, no members are to depart from it without leave. Upon extraordinary occasions, all the members are sometimes summoned; in which case every lord spiritual and temporal, and every knight, citizen, and burgher, is to come to parliament, except he can reasonably and honestly excuse himself; or be amerced; that is, respectively, a lord by the lords, and a commoner by the commons.

All members of parliament, in order that they may attend the public service of their country, have the privilege for themselves of being free from arrests, attachments, imprisonment, &c. for debts, trespasses, &c. but not from arrests for treason, felony, and breach of the peace.

As to the election of members, it is enacted, That candidates shall not make any presents of money to, or treat the electors, after the test of the writ of the summons, or the issuing out of the writs for elections, or after any seat for a member of parliament is become vacant; in case they do, they are declared incapable of serving as members, by 7 W. III. c. 4. And farther, an oath is to be taken by electors, That they have not either received, or had any money, gift, reward, or any office, place, employment, or even promise of money, gift, &c. to them or their use, to give their votes; and in these cases, if they ask, take, or contract for money or reward, either by gift or other device, to give or refuse their votes for any one; or if persons, by gift, &c. corruptly procure any elector to give his vote; they shall forfeit five hundred pounds, and be totally disabled to vote at any election of members of parliament, as also to hold any office, franchise, &c. Likewise officers who admit persons to vote without their taking the aforementioned oath, in case the same be demanded, incur a forfeiture of one hundred pounds; and an oath is to be administered to all the returning officers, that they have not received any money, gift, or place, for the making of their returns; 2 Geo. II. c. 24. 9 Geo. II. c. 38. A knight of the shire must be worth six hundred pounds a year in land, and all other members three hundred pounds.

Anciently all the people had votes in elections, till it was enacted by Henry VI. that none but freeholders, who had a yearly revenue of forty shillings, should be admitted to vote for knights of the shire.

The manner of debating upon, and passing bills in parliament, is as follows: Any member may move to have a bill brought in, which, upon a question put, being agreed to by the majority, this person, with others, is ordered to prepare and bring in the same. When it is ready, a time is appointed for its being read; and after the clerk's reading it, the speaker reads an abstract of it, and puts the question whether or no it shall have a second reading; and after a second reading, the question is put whether or no it shall be committed, which is either to a committee of the whole house if it be of importance, or to a private committee, any member naming the persons. The committee being appointed, and a chairman chosen, the chairman reads the bill paragraph by paragraph, puts every clause to the question, fills up the blanks, and makes amendments, according to the opinion of the majority. The bill thus gone through, the chairman makes his report at the side-bar of the house, reads all the additions and amendments, &c. and moves for leave to bring up the report to the table; which granted, he delivers it to the clerk, who reads the amendments, &c. The speaker then puts the question whether they shall be read a second time; and, if agreed to, he reads them himself. To so many of the amendments as the house acquiesces in, the question is now put, Whether the bill, thus amended, shall be ingrossed and written fair upon parchment, and read a third time? and the bill being ingrossed, the speaker holds it in his hand, and asks if it shall pass. If the majority be for it, the clerk writes on it, *Soit baille aux seigneurs*, "Let it be delivered to the lords;" or if in the house of lords, *Soit baille aux communes*, "Let it be delivered to the commons." If a bill be rejected, it cannot be any more proposed during that session. A bill for a general pardon has but one reading.

When a member of the house of commons speaks, he stands up uncovered, and directs his speech to the speaker only. If what he says be answered by another, he is not allowed to reply the same day, unless personal reflections have been cast upon him: but when the commons, in order to have a greater freedom of debate, have resolved themselves into a committee of the whole house, every member may speak to a question as often as he thinks necessary. In the house of lords they vote, beginning at the puisne, or lowest baron and so up orderly to the highest, every one answering *Content* or *Not content*. In the house of commons they vote by *yeas* and *nays*; and if it be dubious which are the greater number, the house divides. If the question be about bringing any thing into the house, the *yeas* go out; but if it be about any thing the house already has, the *nays* go out. In all divisions the speaker appoints four tellers, two of each opinion. In a committee of the whole house, they divide by changing sides, the *yeas* taking the right and the *nays* the left of the chair; and then there are but two tellers. If a bill pass one house, and the other demur to it, a conference is demanded in the painted chamber, where certain members are deputed from each house; and here the lords sit covered, and the commons stand bare and debate the case. If they disagree, the affair is null; but if they agree,

gree, this, with the other bells that have passed both houses, is brought down to the king in the house of lords, who comes thither clothed in his royal robes; before him the clerk of the parliament reads the title of each bill, and as he reads, the clerk of the crown pronounces the royal assent or dissent. If it be a public bill, the royal assent is given in these words, *Le roy le veut*, "The king will have it so;" if private, *Soit fait comme il est désiré*, "Let the request be complied with:" if the king refuses the bill, the answer is, *Le roy s'avisera*, "The king will think of it;" and if it be a money-bill, the answer is, *Le roy remercie ses loyaux sujets, accepte leur benevolence, & aussi le veut*; "The king thanks his loyal subjects, accepts their benevolence, and therefore grants his consent."

**PARLIAMENTS of France**, are sovereign courts, established by the king, finally to determine all disputes between particular persons, and to pronounce on appeals from sentences given by inferior judges. There are ten of these parliaments in France, of which that of Paris is the chief, its privileges and jurisdiction being of the greatest extent. It consists of six chambers, *viz.* the grand chamber, where causes of audience are pleaded; and five chambers of inquest, where processes are adjudged in writing. This parliament enjoys the privileges of verifying and registering the king's arrests or edicts, without which those edicts are of little or no value.

**PARLIAMENT of Sweden**, consists of four estates, with the king at their head: These states are, 1. The nobility and representatives of the gentry; with whom the colonels, lieutenant-colonels, majors, and captains of every regiment, sit and vote. 2. The clergy; one of which body is elected from every rural deanery of ten parishes; who, with the bishops and superintendants, amount to about two hundred. 3. The burghers, elected by the magistrates and council of every corporation as their representatives, of whom there are four for Stockholm, and two for every other town, amounting in the whole to about an hundred and fifty. 4. The peasants, chosen by the peasants out of every district; who chuse one of their own rank, and not a gentleman, to represent them: these amount to about two hundred and fifty.

All these generally meet at Stockholm; and after the state-affairs have been represented to them from the throne, they separate, and sit in four several chambers or houses, in each of which affairs are carried on by majority of votes; and every chamber has a negative in the passing any law.

**PARMA**, the capital of the duchy of Parma, in Italy, sixty miles north-east of Genoa, is pleasantly situated on a river to which it gives name: E. long. 11°, N. lat. 44° 45'.

**PARNASSIA**, in botany, a genus of the pentandria tetragynia class. The calix consists of five segments, and the corolla of five petals; it has five cordated nectaria, with round buttons on their points; and the capsule has four valves. There is but one species, *viz.* the palustris, or grass of Parnassus, a native of Britain.

**PARNASSUS**, a mountain of Greece, much celebrated by ancient poets, situated near Castro in Livadia.

**PARODY**, a popular maxim, adage, or proverb.

Parody is also a poetical pleasantry, consisting in applying the verses written on one subject, by way of ridicule to another; or in turning a serious work into a

burlesque, by affecting to observe, as nearly as possible, the same rhymes, words, and cadences.

**PARONOMASIA**, in rhetoric, a pun; or a figure whereby words nearly alike in sound, but of very different meanings, are affectedly or designedly used.

**PAROS**, one of the smallest islands of the Cyclades, famous for its marble, situated in E. long. 25° 30', N. lat. 36° 30'.

**PAROTIDES**, in anatomy. See **ANATOMY**, p. 270.

**PAROXYSM**, in medicine, the severe fit of a disease, under which it grows higher, or exasperates, as of the gout, &c.

**PARRELS**, in a ship, are frames made of trucks, ribs, and ropes, which having both their ends fastened to the yards, are so contrived, as to go round about the masts; that the yards, by their means, may go up and down upon the mast; these also, with the breast-ropes, fasten the yards to the masts.

**PARRICIDE**. See **LAW**, Tit. xxxiii. 19.

**PARROT**, in ornithology. See **PSITTACUS**.

**PARSLEY**, in botany. See **APIUM**.

**PARSNIP**, in botany. See **PASTINACA**.

**PARSON**, the rector or incumbent of a parish-church.

**PARSONAGE**, a rectory or parish-church, endowed with a house, glebe, lands, tithes, &c. for the maintenance of a minister, with cure of souls within such parish.

**PARTS of speech**, in grammar, are all the sorts of words which enter the composition of discourse. See **GRAMMAR**.

**PARTERRE**, in gardening, a level division of ground, which, for the most part, faces the south and best front of an house; and is generally furnished with greens, flowers, &c.

**PARTHENIUM**, in botany, a genus of the monœcia pentandria class. The common calix of the male consists of five leaves; and the corolla of the disk are monopetalous. The corollæ of the radius in the female are five; two of each side are males, and the intermediate one female, above a naked seed. There are two species, none of them natives of Britain.

**PARTHIA**, a country of Asia, formerly so called, situated almost in the middle of the modern Persia.

**PARTI, PARTIE, PARTY, or PARTED**, in heraldry, is applied to a shield or escutcheon, denoting it divided or marked out into partitions.

Parti per pale is when the shield is divided perpendicularly into two halves, by a cut in the middle from top to bottom. See Plate CXXXIV. fig. 11.

Parti per fefs is when the cut is across the middle, from side to side.

Parti per bend dexter, is when the cut comes from the upper corner of the shield, on the right hand, and descends athwart to the opposite lower corner.

Parti per bend sinister, is when the cut, coming from the upper left corner, descends across to the opposite lower one.

From these four partitions have proceeded an infinite number of others, of various and extravagant forms.

**PARTICIPLE**, in grammar, an adjective formed of a verb, so called because it participates partly of the properties of a noun, and partly of those of a verb. See **GRAMMAR**.

**PARTICLE**, in physiology, the minute part of a body,

an assemblage of which constitute all natural bodies.

It is the various arrangement and texture of these particles, with the difference of cohesion, &c. that constitute the various kinds of bodies. The smallest particles cohere with the strongest attraction, and compose bigger particles of weaker cohesion; and many of these cohering compose bigger particles, whose vigour is still weaker; and hereupon the operations in chemistry, and the colours of natural bodies, depend, and which, by cohering, compose bodies of sensible bulk. The cohesion of the particles of matter, the Epicureans imagined, was effected by means of hooked atoms; the Aristotelians, by rest; but Sir Isaac Newton shews, that it is done by means of a certain power, whereby the particles mutually attract and tend towards each other. By this attraction of the particles, he shews, that most of the phenomena of the lesser bodies are affected, as those of the heavenly bodies are, by the attraction of gravity.

**PARTICLE**, in grammar, a denomination for all those small words that tie or untie others together, or that express the modes or manners of words. See **GRAMMAR**.  
**PARTNER**, and **PARTNERSHIP**. See **ARITHMETIC**, p. 386.

**PARTURIDGE**, in ornithology. See **TETRAO**.

**PARTURITION**. See **DELIVERY**.

**PARULIDES**, in surgery, tumours and inflammations of the gums, commonly called gum-boils.

They are to be treated with discutients, like other inflammatory tumours.

**PARUS**, in ornithology. See **CERTHIA**.

**PASCHAL**, something belonging to the passover or easter. See **PASSOVER**, and **EASTER**.

**PAISLEY**, a town of Scotland, in the county of Renfrew, six miles west of Glasgow.

**PASQUIN**, a mutilated statue at Rome, in a corner of the palace of the Ursini: it takes its name from a cobbler of that city called Pasquin, famous for his sneers and gibes, and who diverted himself with passing his jokes on all the people who went through that street. After his death, as they were digging up the pavement before his shop, they found in the earth the statue of an ancient gladiator, well cut, but maimed, and half spoiled: this they set up in the place where it was found, and by common consent named it Pasquin. Since that time, all satires are attributed to that figure; and are either put into its mouth, or pasted upon it, as if they were wrote by Pasquin redivivus; and these are addressed by Pasquin to Marforio, another statue at Rome. When Marforio is attacked, Pasquin comes to his assistance; and when Pasquin is attacked, Marforio assists him in his turn.

**PASQUINADE**, a satirical libel fastened to the statue of Pasquin: these are commonly short, merry, and pointed; and from hence the term has been applied to all other lampoons of the same cast.

**PASSADE**, in the menage, is a turn or course of a horse backwards or forwards, on the same spot of ground.

*Birds of PASSAGE*, a name given to those birds which at certain stated seasons of the year remove from certain countries, and at other stated times return to them again, as our quails, woodcocks, storks, nightingales, swallows, and many other species. Among the birds of passage, the fieldfare, the redwing, the woodcock, and the snipe, come to us in the autumn, at the time when the

summer-birds are leaving us, and go from us again in spring, at the time when these return; and of these the two last often continue with us through the summer, and breed; so that the two first seem the only kinds that certainly leave us at the approach of spring, retiring to the northern parts of the continent, where they live during the summer, and breed; and at the return of winter, are driven southerly from those frigid climes, in search of food, which there the ice and snow must deprive them of.

**PASSANT**, in heraldry, a term applied to a lion, or other animal, in a shield, appearing to walk leisurely: for most beasts, except lions, the term trippant is frequently used instead of passant.

**PASSAO**, or **CAPE PASSAO**, a promontory of Peru, just under the equator: W. long 81°.

**PASSAU**, the capital of Bavaria, situated on the confluence of the rivers Danube, Inn, and Ilts: E. long. 13° 30', N. lat. 48° 30'.

**PASSERES** is the name of a class of birds. See **NATURAL HISTORY**.

**PASSERINA**, in botany, a genus of the octandria monogynia class. It has no calix; the corolla consists of four segments, and the stamina lie upon the tube. There are eight species, none of them natives of Britain.

**PASSIFLORA**, in botany, a genus of the gynandria pentagynia class. It has three styli; the calix consists of five leaves, and the corolla of five petals; and the nectarium is a corona; and the berry is supported on a pedicle. There are 26 species, none of them natives of Britain, but are cultivated in gardens for the beauty of their flowers.

**PASSIONS**, in moral philosophy, are certain motions of the soul, which make it pursue what appears to be good, and avoid whatever threatens evil.

By reflecting, says Mr Locke, on the various modifications or tempers of the mind, and the internal sensations which pleasure and pain, good and evil, produce in us, we may thence form to ourselves the ideas of our passions. Thus, by reflecting upon the thought we have of the delight which any thing is apt to produce in us, we form an idea which we call love. Desire is that uneasiness which a man finds in himself upon the absence of any thing, the present enjoyment of which causes delight. Joy is a delight of the mind, arising from the present, or assured approaching, possession of some good. Sorrow is an uneasiness of the mind, upon the thought of a good lost, or the sense of a present evil. Hope is a pleasure in the mind, upon the thought of a probable future enjoyment of a thing which is apt to delight. Fear is an uneasiness of the mind, upon the thought of a future evil likely to befall us. Anger is a discomposure of the mind, upon the receipt of injury, with a present purpose of revenge. Despair is the thought of the unattainableness of any good. Envy is an uneasiness of mind, caused by the consideration of a good we desire, obtained by one we think should not have had it before us.

On the just regulation and subordination of the passions, depends, in a great measure, the happiness of mankind. See **MORAL PHILOSOPHY**.

**PASSIONS**, in medicine, make one of the non-naturals, and produce very sensible effects. Joy, anger, and fear,

are the principal. In the two first, the spirits are hurried with too great vivacity; whereas, in fear or dread, they are as it were curbed and concentrated: whence we may conclude, that they have a very bad effect upon health; and therefore it will be best to keep them within bounds as much as possible, and to preserve an inward serenity, calmness, and tranquillity.

**PASSIONS**, in painting, are the external expressions of the different dispositions and affections of the mind; but particularly their different effects upon the several features of the face: for though the arms, and indeed every part of the body, serve likewise, by their quick, languid, and variously diversified motions, to express the passions of the soul; yet, in painting, this difference is most conspicuous in the face.

In sorrow, joy, love, shame, and compassion, the eyes swell all of a sudden, are covered with a superabundant moisture, and drop tears; and in grief especially, the corners of the mouth hang down, the eye-lids are half shut, and the pupil of the eye is elevated and half covered; and all the other muscles of the face are relaxed, so that the visage appears longer than ordinary.

In fear, terror, fright, and horror, the eye-brows are greatly elevated; the eye lids are expanded as wide as possible, so as to discover the white of the eye; and the pupil is depressed, and half covered by the lower eye-lid; the hair stands an end; the mouth is at the same time wide open; and the lips so far drawn back, that the teeth both of the upper and under jaw appear.

Contentment is expressed by raising one side of the upper lip, so as to discover the teeth, whilst the other side has a movement like that in laughter; the eye, on that side where the teeth appear, is half shut, whilst the other remains open; however, both the pupils are depressed.

In jealousy, envy, hatred, and malice, the eye-brows are knit; and, in laughter, all the parts agree, tending as it were towards the centre of the face.

**PASSION**, or *cross of the PASSION*, in heraldry, is so called, because resembling the shape of that on which our Saviour is thought to have suffered; that is, not crossed in the middle, but a little below the top, with arms short in proportion to the length of the shaft. See plate CXXXIV. fig. 12.

**PASSION-FLOWER**, in botany. See **PASSIFLORA**.

**PASSION-WEEK**, the week immediately preceding the festival of Easter: so called, because in that week our Saviour's passion and death happened.

The Thursday of this week is called Maunday Thursday; the Friday, Good Friday; and the Saturday, the great Sabbath.

**PASSIVE**, in general, denotes something that suffers the action of another called an agent or active power.

In grammar, the verb or word that expresses this passion, is termed a passive verb; which, in the learned languages, has a peculiar termination, as *amor, doceor, &c.* in Latin.

**PASSIVE TITLE**, in Scots law. See **LAW**, Tit. xxvii. 30.

**PASSOVER**, a solemn festival of the Jews, celebrated on the fourteenth day of the month next after the vernal equinox, and instituted in commemoration of their coming out of Egypt; because on the night before their departure the destroying angel, who put to death the first born of the Egyptians, passed over the houses of the Hebrews; which were sprinkled with the blood of a lamb. The whole

transaction is related in the twelfth chapter of Exodus. **PASS PAROLE**, a command given at the head of an army, and thence communicated to the rear by passing it from mouth to mouth.

**PASS-PORTR**, or **PASS**, a licence or writing obtained from a prince or governor, granting liberty and safe conduct to pass through his territories without molestation.

**PASTEBOARD**, a kind of thick paper formed of several sheets of paper pasted together.

The chief use of pasteboard is in binding books, making letter-cases, &c.

**PASTER** *of a horse*, in the manege, is the distance between the joint next the foot, and the coronet of the hoof.

This part should be short, especially in middle-sized horses, because long pasterns are weak, and cannot so well endure travelling.

**PASTER**-JOINT, the joint next a horse's foot.

**PASTIL**, or **PASTEL**, among painters, a kind of paste made of different colours, ground up with gum-water, in order to make crayons.

**PASTIL**, in pharmacy, is a dry composition of sweet-smelling resins, aromatic woods, &c. sometimes burnt to clear and scent the air of a chamber.

**PASTINACA**, in botany, a genus of the pentandria digynia class. The fruit is elliptical, and compressed. There are two species, none of them natives of Britain; but the fativa, or parsnep, is cultivated in gardens for the sake of its root, which we use as food.

**PASTORAL**, in general, something that relates to shepherds; hence we say, pastoral life, manners, poetry, &c.

The original of poetry is ascribed to that age which succeeded the creation of the world: and as the keeping of flocks seems to have been the first employment of mankind, the most ancient sort of poetry was, probably, pastoral. It is natural to imagine, that the leisure of those ancient shepherds admitting and inviting some diversion, none was so proper to that solitary and sedentary life as singing; and that in their songs they took occasion to celebrate their own felicity. From hence a poem was invented, and afterwards improved to a perfect image of that happy time; which, by giving us an esteem for the virtues of a former age, might recommend them to the present. And since the life of shepherds was attended with more tranquillity than any other rural employment, the poets chose to introduce their persons, from whom it received the name of Pastoral.

A pastoral is an imitation of the action of a shepherd, or one considered under that character. The form of this imitation is dramatic, or narrative, or mixed with both; the fable simple; the manners not too polite, nor too rustic; the thoughts are plain, yet admit a little quickness and passion, but that short and flowing; the expression humble, yet as pure as the language will afford; neat, but not florid; easy, and yet lively. In short, the fable, manners, thoughts, and expressions, are full of the greatest simplicity in nature.

The complete character of this poem consists in simplicity, brevity, and delicacy; the two first of which render an eclogue natural, and the last delightful.

**PASTRY**, that branch of cookery, which is chiefly taken up in making pies, pasties, cakes, &c.

**PASTURE**; or **PASTURE-LAND**, that reserved for feeding cattle.

- Pasture land is of such advantage to husbandry, that many prefer it even to corn-land, because of the small hazard and labour that attends it, and as it lays the foundation for most of the profit that is expected from the arable land, because of the manure the cattle afford which are fed upon it. Where dung is not to be bought, as is often the case in places distant from large towns, the farmer is forced to proportion his arable to his pasture-land, in such manner, that the cattle fed on the latter may be sufficient for a supply of dung, so necessary for producing the fruits of the former.
- PATAGONIA**, the most southern part of South America, extending from the mouth of Rio di la Plata, in  $36^{\circ}$  of S. lat. to Cape-Horn, in  $55^{\circ} 30'$ .
- PATAGONULA**, or **PATAGONICA**, in botany, a genus of the pentandria monogynia class. The corolla is rotated; and the stylus is dichotomous. There is but one species, a native of America.
- PATAN**, the capital of a province in the East Indies, situated two hundred miles north of Hucgly in Bengal: E. long.  $89^{\circ}$ , N. lat.  $27^{\circ} 30'$ .
- PATAVINITY**, among critics, denotes a peculiarity of Livy's diction, derived from Patavium, or Padua, the place of his nativity; but wherein this patavinity consists, they are by no means agreed.
- PATCHUGA**, or **PATIOQUE**, a city of Mexico, W. long.  $103^{\circ}$ , N. lat.  $21^{\circ}$ ; subject to Spain.
- PATE**, in fortification, a kind of platform, resembling what is called an horse-shoe.
- PATEE**, or **PATTEE**, in heraldry, a cross, small in the centre, and widening to the extremes, which are very broad. See Plate CXXXIV. fig. 13. which is a cross patee, argent, upon a field sable.
- PATELLA**, in anatomy. See **ANATOMY**, p. 185.
- PATELLA**, the **LIMPET**, is a genus of insects belonging to the order of vermes testacea. It is an animal of the snail kind; its shell consists of one conical valve, without any spiral. There are 36 species, principally distinguished by peculiarities in their shells.
- PATENT**, in general, denotes something that stands open or expanded: thus a leaf is said to be patent when it stands almost at right angles with the stalk.
- PATENT**, or **LETTERS-PATENT**. See **LETTER**.
- PATER PATRATUS**, in Roman antiquity, the principal person among the *faciales* or college of heralds.
- PATER NOSTER**, the Lord's-prayer, so called from the two first words thereof in Latin.
- PATH**, in general, denotes the course or tract marked out or run over by a body in motion. For the path of the moon, &c. see **ASTRONOMY**, p. 465.
- PATHETIC**, whatever relates to the passions, or that is proper to excite or awake them.
- PATHOGNOMONIC**, among physicians, an appellation for a symptom, or concurrence of symptoms, that are inseparable from a distemper, and are found in that only, and in no other.
- PATHOLOGY**, that part of medicine, which explains the nature of diseases, their causes and symptoms.
- PATHOS**, a Greek term, literally signifying passion, is sometimes used for the energy of a discourse, or its power to move the passions.
- PATMOS**, one of the least of the islands of the Archipelago, subject to the Turks: E. long.  $27^{\circ}$ , and N. lat.  $37^{\circ}$ .
- PATNA**, a city of the hither India, the capital of the territory of the same name, in the province of Bengal: E. long.  $85^{\circ}$ , and N. lat.  $26^{\circ}$ .
- PATANCE**, in heraldry, is a cross, stony at the ends; from which it differs only in this, that the ends, instead of turning down like a fleur-de-lis, are extended somewhat in the patee-form. See **FLORY**.
- PATOWMAC**, a great river of Virginia, which arises in the Apalachian mountains, and after separating Virginia from Maryland falls into the bay of Chesapeake.
- PATRAS**, a city and port-town of European Turkey, in the province of the Morea: E. long.  $21^{\circ} 30'$ , and N. lat.  $38^{\circ} 20'$ .
- PATRES CONSCRIPTI**. See **CONSCRIPT** and **SENATOR**.
- PATRIARCHS**, among Christians, are ecclesiastical dignitaries, or bishops, so called from their paternal authority in the church. The power of patriarchs was not the same in all, but differed according to the different customs of countries, or the pleasures of kings and councils: thus the patriarch of Constantinople grew to be a patriarch over the patriarchs of Ephesus and Cæsarea, and was called the oecumenical and universal patriarch; and the patriarch of Alexandria had some prerogatives, which no other patriarch besides himself enjoyed, such as the right of consecrating and approving every single bishop under his jurisdiction.
- PATRIARCHAL CROSS**, in heraldry, is that where the shaft is twice crossed; the lower arms being longer than the upper ones. Plate CXXXIV. fig. 14. is a patriarchal cross, gules, on a field argent.
- PATRICIAN**, among the ancient Romans, a title given to the descendants of the hundred, or, according to others, of the two hundred first senators chosen by Romulus, and by him called *Patres*, *Fathers*.
- PATRIMONY**, a right or estate inherited by a person from his ancestors.
- PATRINGTON**, a market-town of Yorkshire, situated at the mouth of the Humber, fifty miles east of York.
- PATRIPASSIANS**, in church-history, a Christian sect, which appeared about the latter end of the II<sup>d</sup> century; so called from their ascribing the passion to the Father: for they asserted the unity of God in such a manner as to destroy all distinction of persons, and to make the Father and Son precisely the same; in which they were followed by the Sabellians, and others. The author and head of the patripassians was Praxeas, a philosopher of Phrygia in Asia.
- PATROL**, in war, a round or march made by the guards, or watch, in the night-time, to observe what passes in the streets, and to secure the peace and tranquillity of a city or camp.
- PATRON**, among the Romans, was an appellation given to a master who had freed his slave. As soon as the relation of master expired, that of patron began; for the Romans, in giving the slaves their freedom, did not despoil themselves of all right and privileges in them; the law still subjected them to considerable services and duties towards their patrons, the neglect of which was very severely punished.
- PATRON**, in the church of Rome, a saint, whose name a person bears, or under whose protection he is put, and whom he takes particular care to invoke; or a saint, in whose name a church or order is founded.

**PATRON**, in Scots law. See LAW, Tit. v. 5.

**PATRONAGE**, the right of disposing a church or benefice, and enjoying several other privileges, such as having the honourable rights of the church, being interred in the chancel, &c.

*Arms of PATRONAGE*, in heraldry, are those on the top of which are some marks of subjection and dependance: thus the city of Paris bears the flurs de-lis in chief, to shew her subjection to the king; and the cardinals on the top of their arms, bear those of the pope, who gave them the hat, to shew that they are his creatures.

**PATRONYMIC**, among grammarians, is applied to such names of men and women as are derived from those of parents or ancestors.

**PAVETTA**, in botany, a genus of the tetrandria monogynia class. The corolla consists of one funnel-shaped petal; the stylus is crooked; and the berry contains one seed. There is but one species, a native of India.

**PAVIA**, a city of Italy, in the duchy of Milan, capital of the Pavese, the see of a bishop, and university; situated in E. long. 9° 40', and N. lat. 45° 15'.

**PAVIA**, in botany. See *ÆSCULUS*.

**PAULIONISTS**, in church-history, Christian heretics of the III<sup>d</sup> century, disciples of Paul Samosatenis bishop of Antioch, who denied Christ's divinity, maintaining that when we call him the Son of God, we do not thereby mean that he is really and truly God; but only that he was so perfect a man, and so superior in virtue to all others, that he had this name given him by way of eminence.

**PAULICIANS**, Christian heretics of the VII<sup>th</sup> century, disciples of one Constantine, a native of Armenia, and a favourer of the errors of Manes; who, as the name Manichees was become odious to all nations, gave those of his sect the title of Paulicians, on pretence that they followed only the doctrine of St Paul.

**PAULINIA**, in botany, a genus of the octandria trigynia class. The calix consists of four leaves, the corolla of four petals, and the nectarium of four unequal leaves; it has three compressed, membranaceous capsules. There are seven species, none of them natives of Britain.

**PAVO**, in ornithology, a genus belonging to the order of gallinæ. The head is covered with feathers which bend backwards; and the feathers of the tail are very long, and beautifully variegated with eyes of different colours. There are three species, *viz.* 1. The cristatus, or common peacock of English authors, has a compressed crest, and solitary spurs, and is a native of Ceylon. 2. The bicarcaratus has a small crest, and double spurs: It is a native of China. 3. The muticus, has a sharp pointed crest, and no spurs, and the orbits of the eyes are red. It is found in Japan.

**PAVO**, in astronomy. See ASTRONOMY, p. 487.

**PAURÆDRASTYLÆ**, in natural history, the name of a genus of perfect crystals, with double pyramids, and no intermediate column, composed of twelve planes, or two hexangular pyramids, joined base to base.

**PAUSANIA**, in Grecian antiquity, a festival in which were solemn games, wherein nobody contended but free-born Spartans; in honour of Pausanias, the Spartan general, under whose conduct the Greeks overcame Marathon, in the famous battle at Plateæ.

**PAUSE**, a stop or cessation of speaking, singing, playing,

or the like. The use of pointing in grammar, is to make proper pauses, in certain places. There is a pause in the middle of each verse; in an hemistich it is called a rest or repose.

**PAW**, in the menage. A horse is said to paw the ground, when his leg, being either tired or painful, he does not rest it upon the ground, and fears to hurt himself as he walks.

**PEA**, in botany. See *PRIMUM*.

**PEACH**, in botany. See *AMYDALUS*.

**PEACOCK**, in ornithology. See *PAVO*.

**PEAK**, a rocky mountainous country in the west of Derbyshire, remarkable for its mines of lead and iron, &c.

**PEAN**, in heraldry, is when the field of a coat of arms is sable, and the powderings or.

**PEAR**, in botany. See *PYRUS*.

**PEARCH**, in ichthyology. See *PERCA*.

**PEARCH-GLUE**, the name of a kind of glue of remarkable strength and purity, made from the skins of peaches.

**PEARL**, in natural history, a hard, white, shining body, usually roundish, found in a testaceous fish resembling an oyster.

Pearls, though esteemed of the number of gems by our jewelers, and highly valued, not only at this time, but in all ages, proceed only from a distemper in the creature that produces them, analogous to the bezoars, and other stony concretions in several animals of other kinds.

The fish in which these are usually produced is the East-Indian pearl-oyster, as it is commonly called. Besides this shell, there are many others that are found to produce pearls; as the common oyster, the mussel, and several others; the pearls of which are often very good; but those of the true Indian berberis, or pearl-oyster, are in general superior to all. The small or seed-pearls, also called ounce-pearls, from their being sold by the ounce, and not by tale, are vastly the most numerous and common; but as in diamonds, among the multitudes of small ones, there are smaller numbers of larger found, so in pearls there are larger and larger kinds; but as they increase in size, they are proportionably less frequent, and this is one reason of their great price. We have Scotch pearls frequently as big as a little tare, some as big as a large pea, and some few of the size of a horse-bean; but these are usually of a bad shape, and of little value in proportion to their weight. Philip II. of Spain had a pearl perfect in its shape and colour, and of the size of a pigeon's egg. The finest, and what is called the true shape of the pearl, is a perfect round; but if pearls of a considerable size are of the shape of a pear, as is not frequently the case, they are not less valued, as they serve for ear-rings and other ornaments. Their colour ought to be a pure white, and that not a dead and lifeless, but a clear and brilliant one; they must be perfectly free from any foulness, spot or stain; and their surfaces must be naturally smooth and glossy. For they bring their natural polish with them, which art is not able to improve.

All pearls are formed of the matter of the shell, and consist of a number of coats spread with perfect regularity one over another, in the manner of the several coats of an onion, or like the several strata of the stones found in the bladders or stomachs of animals, only much thinner. *Manner of fishing for PEARLS in the East-Indies.* There are two seasons for pearl-fishing: the first is in March and

April, and the last in August and September; and the more rain there falls in the year, the more plentiful are these fisheries. At the beginning of the season there are sometimes two hundred and fifty barks on the banks; the larger barks having two divers, and the smaller one. As soon as the barks arrive at the place where the fish lie, and have cast anchor, each diver binds a stone six inches thick, and a foot long, under his body; which serves him as ballast, prevents his being driven away by the motion of the water, and enables him to walk more steadily under the waves. They also tie another very heavy stone to one foot, by which they are very speedily sent to the bottom of the sea: and as the oysters are usually firmly fastened to the rocks, they arm their hands with leather mittens to prevent their being wounded in pulling them violently off; but this task some perform with an iron-rake. In the last place, each diver carries down with him a large net in the manner of a sack, tied to his neck by a long cord, the other end of which is fastened to the side of the bark. This net is to hold the oysters gathered from the rock, and the cord is to pull up the diver when his bag is full or he wants air.

In this equipage he sometimes precipitates himself sixty feet under water; and as he has no time to lose, he no sooner arrives at the bottom, than he begins to run from side to side tearing up all the oysters he meets with, and cramming them into his budget.

At whatever depth the divers are, the light is so great, that they easily see whatever passes in the sea: and to their great consternation sometimes perceive monstrous fishes, from which all their address in mudding the water, &c. will not always save them, but they unhappily become their prey: and of all the dangers of the fishery, this is one of the greatest and most usual. The best divers will keep under water near half an hour, and the rest do not stay less than a quarter. During this time they hold their breath without the use of oils, or any other liquors; only acquiring the habit by long practice. When they find themselves straightened, they pull the rope to which the bag is fastened, and hold fast by it with both hands; when those in the bark, taking the signal, heave them up into the air, and unload them of their fish, which is sometimes five hundred oysters, and sometimes not above fifty. Some of the divers need a moment's respite to recover breath; others jump in again instantly, continuing this violent exercise without intermission for several hours.

On the shore they unload their barks, and lay their oysters in an infinite number of little pits dug in the sand four or five feet square; raising heaps of sand over them to the height of a man; and in this condition they are left, till the rain, wind, and sun have obliged them to open, which soon kills them: upon this the flesh rots and dries, and the pearls, thus disengaged, fall into the pit, on their taking out the shells. After clearing the pits of the grosser filth, they sift the sand several times in order to find the pearl: but whatever care they take, they always lose a great many. After cleaning and drying the pearls, they are passed through a kind of sieve, according to their sizes; the smallest are then sold as seed-pearls, and the rest put up to auction, and sold to the highest bidder.

*Artificial PEARLS*, are made by reducing seed-pearls to a

paste, by means of a chemical preparation called mercurial water, making the beads in silver-moulds, boring them with a hog's bristle, and drying them in a closed glass in the sun.

Beads, in imitation of pearls, are also made of wax, and covered with the scales of several kinds of fishes.

*Mother of PEARL*, is the shell, not of the pearl-oyster, but of another sea-fish of the oyster-kind. This shell on the inside is extremely smooth, and of the whiteness and water of pearl itself; and it has the same lustre on the outside, after the first laminae or scales have been cleared off with aquafortis and the lapidaries mill. Mother of pearl is used in inlaid works, and in several toys, as snuff-boxes, &c.

*PEARL-ISLANDS*, several small islands situated in the bay of Panama: W. long. 81°, and between 7° and 9° of north lat.

*PEAT*, a kind of turf used for fuel in several countries.

*PEBBLES*, the name of a genus of fossils, distinguished from the flints and homochroa by their having a variety of colours. These are defined to be stones, composed of a crystalline matter, debased by earths of various kinds in the same species, and then subject to veins, clouds; and other variegations; usually formed by incrustations round a central nucleus, but sometimes the effect of a simple concretion, and veined like the agates, by the disposition the motion of the fluid they were formed in gave their differently coloured substances.

*PECCANT*, in medicine, a term used for those humours of the body which offend either by their quantity or quality.

*PECK*, a measure of capacity, four of which make a bushel.

*PECORA*, in natural history, the name of a class of quadrupeds. See *NATURAL HISTORY*.

*PECTORAL*, an epithet for medicines good for disorders of the breast and lungs.

*PECTORALIS*, in anatomy. See *ANATOMY*, p. 194; 195.

*PECTORIS OS*, in anatomy. See *ANATOMY*, p. 175.

*PECULIUM*, the stock or estate which a person in the power of another, as a slave, may acquire by his industry.

*PEDAGOGUE*, a tutor or master, to whom is committed the discipline and direction of a scholar.

*PEDANT*, is used for a rough unpolished man of letters, who makes an impertinent use of the sciences, and abounds in unseasonable criticisms and observations.

*PEDARIAN*, in Roman antiquity, those senators who signified their votes by their feet, not their tongues; that is, such as walked over to the side of those whose opinion they approved of, in divisions of the house.

*PEDESTAL*, in architecture. See *ARCHITECTURE*, p. 356.

*PEDICLE*, among botanists, that part of a stalk which immediately sustains the leaf of a flower or a fruit, and is commonly called a foot-stalk.

*PEDICULARIS*, in botany, a genus of the didynamia angiosperma class. The calix consists of five segments; the capsule is sharp-pointed, oblique, and has two cells; and the seeds are covered with a tunic. There are 14 species, two of which are natives of Britain, viz. the sylvatica, or common louse-wort; and the palustris, or marsh louse-wort.

This plant is of a cooling and drying nature, whence

it is recommended in fistulas and other sinous ulcers. **PEDICULUS**, LOUSE, in zoology, a genus of insects belonging to the order of aptera. It has six feet, two eyes, and a sort of sting in the mouth; the feelers are as long as the thorax; and the belly is depressed, and sublobated. There are 40 species, denominated from the different creatures they inhabit. The best antidote against this kind of vermin, is cleanliness.

**PEDILUVIUM**, a bathing of the feet. This bath may be prepared of the same ingredients with other baths. It may either consist of light pure water alone; or, to correct the qualities of heavy and hard water, a lixivium or bran of wheat or chamomile-flowers may be added.

**PEDIMENT**, in architecture. See ARCHITECTURE, p. 356.

**PEDIR**, a town in the island of Sumatra, in the East Indies, situated in E. long  $94^{\circ}$  lat.  $5^{\circ}$ .

**PEDUNCLE**, among botanists. See PEDICLE.

**PEDUNCULI CEREBELLI**, in anatomy. See ANATOMY, p. 287.

**PEEBLES**, a town of Scotland, capital of the shire of Tweedale, situated on the river Tweed, twenty-two miles south of Edinburgh.

**PEEK**, in the sea-language, is a word used in various senses. Thus the anchor is said to be a-peek, when the ship being about to weigh comes over her anchor in such a manner that the cable hangs perpendicularly betwixt the haufe and the anchor. To heave a peek is to bring the peek so as that the anchor may hang a-peek.

**PEER**, in general, signifies an equal, or one of the same rank and situation.

The term peer is now applied to those who are impanelled in an inquest upon a person for convicting or acquitting him of any offence laid to his charge; and the reason why the jury is so called, is, because by the common law, and the custom of this kingdom, every person is to be tried by his peers or equals, a lord by the lords, and a commoner by commoners.

**PEER of the realm**, a noble lord who has a seat and vote in the house of lords, which is also called the house of peers. These lords are called peers, because, though there is a distinction of degrees in our nobility, yet in public actions they are equal, as in their votes in parliament, and in trying any nobleman or other person impeached by the commons, &c. See PARLIAMENT.

**PEERS of France**, the twelve great lords of that kingdom, of which six are dukes, and six counts; and of these, six are ecclesiastics, and six laymen: thus, the archbishop of Rheims, and the bishop of Laon and Langres are dukes and peers; and the bishops of Chalons, the Marne, Noyons, and Beauvais, are counts and peers. The dukes of Burgundy, Normandy, and Aquitaine, are lay peers and dukes; and the counts of Flanders, Champagne, and Toulouse, lay peers and counts. These peers still assist at the coronation of kings, either in person or by their representatives, where each performs the functions attached to his respective dignity: but as the six lay peerages are all at present united to the crown except that of the count of Flanders, six lords of the first quality are chosen to represent them; but the ecclesiastical peers usually assist in person. At present the title of peer is bestowed on every lord whose estate is erected into a peerage, the num-

ber of which is uncertain, and it depends entirely on the king.

**PEERESS**, a woman who is noble by descent, creation, or marriage.

If a peeress, by descent or creation, marries a person under the degree of nobility, she still continues noble; but if she obtains that dignity only by marriage, she loses it on her afterwards marrying a commoner; yet, by the courtesy of England, she always retains the title of her nobility.

**PEEVIT**, in ornithology. See LARUS.

**PEGANUM**, in botany, a genus of the dodecandria monogynia class. The corolla consists of five petals, and the calix of five leaves; the capsule has three cells, and three valves, containing many seeds. There are two species, none of them natives of Britain.

**PEGASUS**, in astronomy. See ASTRONOMY, p. 487.

**PEGU**, the capital of the kingdom of Pegu, and situated upon a river of the same name, in  $97^{\circ}$  E. long. and N. lat.  $17^{\circ} 30'$ .

**PEKIN**, the metropolis of the empire of China, is situated in E. long.  $111^{\circ}$ , and N. lat.  $40^{\circ}$ .

It is about twenty miles in circumference, and is said to contain 2,000,000 of people.

**PELAGIANS**, a Christian sect who appeared about the latter end of the fourth, or the beginning of the fifth century.

Pelagius, the author of this sect, was born in Wales, and his name was Morgan, which in the Welsh language signifies sea-born; from whence he had his Latin name Pelagius. Some of our ancient historians pretend that he was abbot of Bangor: but this is impossible, because the British monasteries were of a later date. St Austin gives him the character of a very pious man, and a Christian of no vulgar rank: according to the same father, he travelled to Rome, where he associated himself with persons of the greatest learning and figure, and wrote his commentaries on St Paul's Epistles, and his letters to Melania and Demetrias; but being charged with heresy, he left Rome, and went into Africa, and from thence to Jerusalem, where he settled. He died somewhere in the east; but where, is uncertain. He was charged with maintaining the following doctrines: 1. That Adam was by nature mortal, and, whether he had sinned or not, would certainly have died. 2. That the consequences of Adam's sin were confined to his own person. 3. That newborn infants are in the same condition with Adam before the fall. 4. That the law qualified men for the kingdom of heaven, and was founded upon equal promises with the gospel. 5. That the general resurrection of the dead does not follow in virtue of our Saviour's resurrection. 6. That the grace of God is given according to our merits. 7. That this grace is not granted for the performance of every moral act; the liberty of the will, and information in points of duty being sufficient, &c.

**PELICANUS**, in ornithology, a genus belonging to the order of anseres. The bill is strait, without teeth, and crooked at the point; the face is naked; and the feet are palmated. There are eight species, principally distinguished by the shape of their tails.

**PELICAN**, in ornithology. See PELICANUS.

**PELICAN**, in chemistry. See CHEMISTRY, p. 109.

**PELLETS**,

**PELLETS**, in heraldry, those roundles that are black, called also ogresses and gunstones, and by the French *tôteaux de sable*.

**PELLICLE**, among physicians, &c. denotes a thin film, or fragment of a membrane.

**PELVIS**, in anatomy. See *ANATOMY*, p. 173.

**PEMBROKE**, the capital of Pembrokeshire, in south Wales: W. long.  $5^{\circ}$ , N. lat.  $51^{\circ} 45'$ . This town sends two members to parliament.

**PENAL action**, in Scots law. See *LAW*, Tit. xxx 17.

**PENANCE**, a punishment, either voluntary, or imposed by authority, for the faults a person has committed. Penance is one of the seven sacraments of the Romish church. Besides fasting, alms, abstinence, and the like, which are the general conditions of penance; there are others of a more particular kind, as the repeating a certain number of ave-marys, pater-nosters, and credos. wearing a hair-shirt, and giving one's self a certain number of stripes. In Italy and Spain it is usual to see Christians almost naked, loaded with chains and a cross, and lashing themselves at every step.

**PENEA**, in botany, a plant of the tetrandria monogynia class. The calix consists of two leaves; the corolla is bell shaped; the stylus is quadrangular; and the capsule is triangular, with four cells containing eight seeds. There are three species, none of them natives of Britain.

**PENATES**, in Roman antiquity, a kind of tutelary deities, either of countries or particular houses; in which last sense, they differed in nothing from the lares. See *LARES*.

**PENCIL**, an instrument used by painters for laying on their colours. Pencils are of various kinds, and made of various materials; the larger sorts are made of boars bristles, the thick ends of which are bound to a stick, bigger or less according to the uses they are designed for: these, when large, are called brushes. The finer sorts of pencils are made of camels, badgers, and squirrels-hair, and of the down of swans; these are tied at the upper end with a piece of strong thread, and inclosed in the barrel of a quill.

**PENDANT**, an ornament hanging at the ear, frequently consisting of diamonds, pearls, and other precious stones.

**PENDANTS**, in heraldry, parts hanging down from the label, to the number of three, four, five, or six at most, resembling the drops in the Doric frieze. When they are more than three, they must be specified in blazoning.

**PENDANTS** of a ship, are those streamers or long colours which are split and divided into two parts ending in points, and hung at the head of masts, or at the yard-arm ends.

**PENDULOUS**, a term applied to any thing that bends or hangs downwards.

**PENDULUM**, in mechanics, denotes any heavy body, so suspended as that it may vibrate or swing, backwards and forwards, about some fixed point, by the force of gravity. See *MECHANICS*.

**PENETRALE**, in Roman antiquity, properly denoted the chapel consecrated to the penates, or household-gods.

**PENGUIN ISLAND** and **BAY**, are situated on the coast of Patagonia in South America: W. long.  $70^{\circ}$ , S. lat.  $47^{\circ}$ .

**PENGUIN** in ornithology. See *ALCA*.

**PENICHE**, a port-town of Portugal, in the province of Estremadura, situated on the Ocean forty miles north of Lisbon: W. long.  $9^{\circ} 6'$ , N. lat.  $39^{\circ} 20'$ .

**PENICILLUS**, among surgeons, is used for a tent to be put into wounds or ulcers.

**PENINSULA**, in geography, a portion or extent of land, joining to the continent by a narrow neck or isthmus, the rest being encompassed with water.

**PENIS**, in anatomy. See *ANATOMY*, p. 270.

**PENISCOLA**, a port town of Spain, in the province of Valencia, situated on the Mediterranean, under the meridian of London, and in N. lat.  $40^{\circ} 29'$ .

**PENNY**, an ancient silver-coin, which, though now little used, was the only one current among our Saxon ancestors.

**PENNY EARTH**, in agriculture, denotes a hard loamy, or sandy earth, with a large proportion of sea-shells intermixed with it.

**PENNY-WEIGHT**, a troy-weight, containing twenty-four grains, each of which is equal in weight to a grain of wheat, gathered out of the middle of the ear, and well dried.

**PENRISE**, a port-town of Wales, in the county of Glamorgan, situated on Bristol channel, seventeen miles south of Caermarthen.

**PENRYN**, a borough-town of Cornwall, near a bay of the English channel: W. long.  $5^{\circ} 35'$ , N. lat.  $50^{\circ} 20'$ .

It sends two members to parliament.

**PENSANCE**, a market-town of Cornwall, eight miles east of the Land's end.

**PENSILVANIA**, one of the English plantations in America, two hundred miles in length, and almost as much in breadth: situated between  $74$  and  $78^{\circ}$  of west longitude, and between  $39$  and  $42^{\circ}$  of north latitude: a fine fruitful country, bounded by the five nations of the Iroquois on the north, by New-Jersey and New-York on the east, and by Maryland on the south and west. It is a proprietary government, the heirs of Mr. Penn, a quaker, who settled this country, appointing the governor.

**PENSION**, a sum of money paid annually for services or considerations already past. The yearly payment of each member to the houses of the inns of courts, are likewise termed pensions; and the yearly assembly of the members of the society of Gray's Inn, to consult on the affairs of the house, is also called a pension.

**PENSIONER** in general, denotes a person who receives a pension, yearly salary, or allowance. Hence,

The band of gentleman-pensioners, the noblest sort of guard to the king's person, consists of forty gentlemen, who receive a yearly pension of one hundred pounds. This honourable band was first instituted by king Henry VIII and their office is to attend the king's person, with their battle-axes, to and from his chapel-royal, and to receive him in the presence chamber, or coming out of his privy-lodgings; they are also told to attend at all great solemnities, as coronations, St. George's feast, public audiences of ambassadors, at the sovereign's going to parliament &c.

They are each obliged to keep three double horses and a servant, and so are properly a troop of horse. They wait half at a time, quarterly; but on Christmas-day, Easter-day, Whitfunday, &c. and on extraordinary occasions they are all obliged to give their attendance.

**PENTACROSTIC**, in poetry, a set of verses so disposed as that there are always five acrostics of the same name, in five divisions of each verse.

**PENTAEDROSTYLA**, in natural history, the name of a genus of spars. See *SPAR*.

The bodies of this genus are spars, in form of pentagonal columns, terminated by pentangular pyramids at one end, and irregularly affixed at the other to some solid body.

**PENTAGON**, in geometry, a figure of five sides and five angles. See **GEOMETRY**.

**PENTAGRAPH**, an instrument whereby designs of any kind may be copied in what proportion you please, without being skilled in drawing.

**PENTAMETER**, in ancient poetry, a kind of verse consisting of five feet, or metres; whence the name.

The two first feet may be either dactyls or spondees, at pleasure; the third is always a spondee, and the two last anapests.

**PENTANDRIA**, in botany. See **BOTANY**, p. 635.

**PENTAPETALOUS**, an appellation given to flowers that consist of five petals or leaves.

**PENTAPETES**, in botany, a genus of the monodelphia decandria class. The calix is simple; the capsule has five cells, containing many membranaceous seeds. There are three species, none of them natives of Britain.

**PENTASTYLE**, in architecture, a building wherein there are five rows of columns.

**PENTATEUGH**, an appellation given to the first five books of the Old Testament, *viz.* Genesis, Exodus, Leviticus, Numbers, and Deuteronomy, &c.

**PENTATHLON**, in antiquity, a general name for the five exercises performed at the Grecian games, *viz.* wrestling, boxing, leaping, running, and playing at the discus.

**PENTECOST**, a solemn festival of the Jews, so called because it was celebrated on the fiftieth day after the sixteenth of the month Nisan, which was the second day of the passover. See **PASSOVER**.

The feast of pentecost was instituted in memory of the Law's being given on the fiftieth day after the Israelites came out of Egypt.

**PENTHORUM**, in botany, a genus of the decandria pentagynia class. The calix consists of five segments; the petals are from five to nine; and the capsule has five cells. There is but one species, *viz.* the sedoides, a native of Virginia.

**PENULTIMA**, or **PENULTIMATE SYLLABLE**, in grammar, denotes the last syllable but one of a word, and hence the anti-penultimate syllable is the last but two, or that immediately before the penultima.

**PENUMBRA**, in astronomy, a partial shade observed between the perfect shadow and the full light in an eclipse.

It arises from the magnitude of the sun's body; for were he only a luminous point, the shadow would be all perfect; but by reason of the diameter of the sun, it happens that a place which is not illuminated by the whole body of the sun does yet receive rays from a part thereof.

**PEPLIS**, in botany, a genus of the hexandria monogynia class. The perianthium is bell-shaped, with twelve segments; the petals are six, inserted into the calix; and the capsule has two cells. There are two species, none of them natives of Britain.

**PEPO**, in botany. See **CUCURBITA**.

**PEPPER**, in botany, See **PIPER**.

**PEPPER-MINT**. See **MENTHA**.

**PERA**, one of the suburbs of Constantinople, where ambassadors and Christians usually reside.

**PERAMBULATOR**, in surveying, an instrument for

measuring distances, called also *pedometer*, *way-wifer*, and surveying wheel.

It consists of a wheel AA (Plate CXXXIV. fig. 15. n° 1.) two feet seven inches and a half in diameter; consequently half a pole, or eight feet three inches, in circumference. On one end of the axis is a nut, three quarters of an inch in diameter, and divided into eight teeth; which, upon moving the wheel round, fall into the eight teeth of another nut *c* (*ibid.* n° 2.) fixed on one end of an iron-rod Q, and thus turn the rod once round in the time the wheel makes one revolution. This rod, lying along a groove in the side of the carriage of the instrument, under the dotted line, has at its other end a square hole, into which is fitted the end *b* of a small cylinder P. This cylinder is disposed (*ibid.* n° 3.) under the dial-plate of a movement, at the end of the carriage B, in such a manner as to be moveable about its axis: its end *a* is cut into a perpetual screw, which falling into the thirty-two teeth of a wheel perpendicular thereto, upon driving the instrument forward, that wheel makes a revolution each sixteenth pole. On the axis of this wheel is a pinion with six teeth, which, falling into the teeth of another wheel of sixty teeth, carries it round every hundred and sixtieth pole, or half a mile.

This last wheel, carrying a hand or index round with it over the divisions of a dial-plate, whose outer limb is divided into one hundred and sixty parts, corresponding to the one hundred and sixty poles, points out the number of poles passed over. Again, on the axis of this last wheel is a pinion, containing twenty teeth, which falling into the teeth of a third wheel which hath forty teeth, drives it once round in three hundred and twenty poles, or a mile. On the axis of this wheel is a pinion of twelve teeth, which, falling into the teeth of a fourth wheel having seventy-two teeth, drives it once round in twelve miles.

This fourth wheel, carrying another index over the inner limb of the dial-plate, divided into twelve for miles, and each mile subdivided into halves, quarters, and furlongs, serves to register the revolutions of the other hand, as to keep account of the half miles and miles passed over as far as twelve miles.

The use of this instrument is obvious from its construction. Its proper office is in the surveying of roads and large distances, where a great deal of expedition, and not much accuracy, is required. It is evident, that driving it along, and observing the hands, has the same effect as dragging the chain, and taking account of the chains and links.

Its advantages are its handiness and expedition; its contrivance is such, that it may be fitted to the wheel of a coach, in which state it performs its office, and measures the road without any trouble at all.

**PERCA**, the **PEARCH**, in ichthyology, a genus belonging to the order of thoracici. The head is furnished with scaly and serrated opercula; there are seven rays in the membrane of the gills; and the fins on the back are prickly. There are 38 species, principally distinguished by peculiarities in the back fins.

**PERCEPTION**, in logic, the first and most simple act of the mind, whereby it perceives or is conscious of its ideas. See **LOGIC**.

**PERCH**. See **PERCA**.

**PERCOLATION.** See **FILTRATION.**

**PERCUSSION,** in mechanics, the impression a body makes in falling or striking upon another, or the shock of two bodies in motion.

**PERDIX** See **TETRAO.**

**PERENNIAL,** in botany, is applied to those plants whose roots will abide many years, whether they retain their leaves in winter or not: those which retain their leaves are called evergreens; but such as cast their leaves, are called deciduous, or perdisols.

**PERFORANS MANUS,** in anatomy. See **ANATOMY,** p. 201.

**PERFORANS PEDIS,** in anatomy. See **ANATOMY,** p. 211.

**PERFORATUS MANUS,** in anatomy. See **ANATOMY,** p. 201.

**PERFORATUS PEDIS,** in anatomy. See **ANATOMY,** p. 211.

**PERFUME,** an agreeable odour, affecting the organ of smelling. The generality of perfumes are made up of musk, ambergrease, civet, rose and cedar-woods, orange-flowers, jasmín, joaquilla, tuberoses, and other odoriferous flowers. Those drugs commonly called aromatics, such as storax, frankincense, benzoin, cloves, mace, &c. enter the composition of a perfume: some are also composed of aromatic herbs or leaves, as lavender, marjoram, sage, thyme, hyssop, &c.

Perfumes were anciently very much in use: but since people are become sensible of the harm they do to the head, they are generally disused among us; however, they are still common in Spain and Italy.

**PERGA,** a port-town of European Turkey, in the province of Albina, opposite to the island of Corfu, in E. long. 21°, N. lat. 39° 20'.

**PERGAMUS,** an ancient city of the lesser Asia, in the province of Phrygia, situated north of Smyrna.

**PERIAGOGE,** in rhetoric, is used where many things are accumulated into one period which might have been divided into several.

**PERIANTHIUM,** in botany. See **BOTANY,** p. 637.

**PERICARDIUM,** in anatomy. See **ANATOMY,** p. 279.

**PERICARPIUM,** among botanists. See **BOTANY,** p. 637.

**PERICHORUS,** in antiquity, a name given by the Greeks to their profane games and combats, that is, to such as were not consecrated to any of the gods.

**PERICRANIUM,** in anatomy. See **ANATOMY,** p. 288.

**PERIGEE,** in astronomy, that point of the sun's or moon's orbit wherein they are at their least distance from the earth, in which sense it stands opposed to apogee.

**PERIGRAPHE,** a word usually understood to express a careless or inaccurate delineation of any thing; but in Vesalius it is used to express the white lines or impressions that appear in the musculus rectus of the abdomen.

**PERIGUEUX,** a city of France, in the province of Guienne, capital of the territory of Perigord, situated on the river Lisse: in E. long. 25°, N. lat. 45° 15'.

**PERIHELIIUM,** in astronomy, that point of a planet's or comet's orbit, wherein it is in its least distance from the sun; in which sense it stands in opposition to aphelium.

**PERIMETER,** in geometry, the bonds or limits of any figure or body.

**PERINEUM,** or **PERINEUM,** in anatomy, the space between the anus and the parts of generation, divided into

two equal lateral divisions, by a very distinct line, which is longer in males than in females.

**PERIOD,** in astronomy, the time taken up by a star or planet in making a revolution round the sun; or the duration of its course till it return to the same point of its orbit. See **ASTRONOMY,**

**PERIOD,** in grammar, denotes a small compass of discourse, containing a perfect sentence, and distinguished at the end by a point, or full stop, thus (.) ; and its members or divisions marked by commas, colons, &c.

**PERIODIC,** or **PERIODICAL,** something that terminates and comprehends a period; such is a periodic month, being the space of time wherein the moon dispatches her period.

**PERIOECI,** in geography, such inhabitants of the earth, as have the same latitudes, but opposite longitudes; or live under the same parallel, and the same meridian, but in different semicircles of that meridian, or in opposite points of the parallel.

**PERIOPHTHALMIUM,** in natural history. See **NIC-TITATING MEMBRANE.**

**PERIOSTEUM,** in anatomy. See **ANATOMY,** p. 145.

**PERIPATETIC PHILOSOPHY,** that system taught and established by Aristotle; and maintained by his followers the peripatetics, called also Aristotelians.

**PERIPETIA,** in the drama, that part of a tragedy wherein the action is turned, the plot unravelled, and the whole concludes.

**PERIPHERY,** in geometry, the circumference of a circle, ellipsis, or any other regular curvilinear figure.

**PERIPLOCA,** in botany, a genus of the pentandria digynia class. The nectarium surrounds the inside of the flower, and includes the filaments and styli. There are four species, none of them natives of Britain.

**PERIPNEUMONY,** in medicine. See **MEDICINE,** p. 91.

**PERISCI,** in geography, the inhabitants of either frigid zone, between the polar circles and the poles; where the sun, when in the summer-signs, moves only round about them, without setting, and consequently their shadows, in the same day, turn to all the points of the horizon.

**PERISTALTIC,** a vermicular spontaneous motion of the intestines, performed by the contraction of the circular and longitudinal fibres, of which the fleshy coats of the intestines is composed; by means whereof the chyle is driven into the orifices of the lacteal veins, and the fæces are protracted towards the anus.

**PERISTAPHYLINUS,** in anatomy. See **ANATOMY,** p. 303.

**PERISTYLE,** in ancient architecture, a building encompassed with a row of columns on the inside.

**PERISYSTOLE,** the interval of rest between the two motions of the heart, viz. that of the systole or contraction, and that of the diastole or dilation.

**PERITONÆUM,** in anatomy. See **ANATOMY,** p. 257.

**PERITROCHIUM,** in mechanics, denotes a wheel, or circle, concentric with the base of a cylinder, and moveable together with it about an axis. See **MECHANICS.**

**PERJURY,** in law, the crime of swearing falsely, where a lawful oath is administered by one in authority, in a matter relating to the issue or cause in question, whether it be a person's own wilful act, or done by the subornation of others.

At the common law, perjury, and the subornation of it,

it, are punishable by fine, imprisonment, pillory, transportation, &c. See *LAW*, Tit. xxxiii. 34.

**PERMEABLE**, a term applied to bodies of so loose and porous a structure, as to let some things pass through them.

**PERMUTATION**, in commerce, the same with bartering. See *COMMERCE*.

**PERNAMBUCO**, a province of Brazil, in America, bounded by the province of Tamera on the north, by the Atlantic ocean on the east, by the province of Seregippa on the south, and by the country of the Tapuyers on the west; being two hundred miles long, and one hundred and fifty broad.

**PERONÆUS**, in anatomy. See *ANATOMY*, p. 209.

**PERORATION**, in rhetoric, the epilogue, or last part of an oration, wherein what the orator had insisted on through his whole discourse, is urged afresh with greater vehemence and passion.

**PEROUSA**, a town of Italy, in the province of Piedmont, capital of one of the valleys of the Vaudois, situated twelve miles south-west of Turin.

**PERPENDICULAR**, in geometry, a line falling directly on another line, so as to make equal angles on each side. See *GEOMETRY*.

**PERPETUAL MOTION**. See *MOVEMENT*.

**PERPIGNAN**, a city of Spain, in the province of Catalonia, capital of the territory of Roussillon, situated on the river Latet: in E. long.  $2^{\circ} 35'$ , N. lat.  $43^{\circ}$ .

**PERRUKE**, or **PERRIWIG**, was anciently used for a head of long natural hair, particularly such as was curled and adjusted with great care. But it is now used for a set of borrowed hair, curled, baked, interwoven between four threads, and sewed together on a cawl.

**PERRY**, a drink made of pears, in the same manner as cyder is made from apples. See *CYDER*.

**PERSECUTION**, is any pain or affliction which a person designedly inflicts upon another; and, in a more restrained sense, the sufferings of Christians on account of their religion.

Historians usually reckon ten general persecutions; the first of which was under the emperor Nero, thirty one years after our Lord's ascension; when that emperor having set fire to the city of Rome, threw the odium of that execrable action on the Christians, who under that pretence were wrapped up in the skins of wild beasts, and worried and devoured by dogs; others were crucified, and others burnt alive. The second was under Domitian, in the year 95. In this persecution St John the apostle was sent to the isle of Patmos, in order to be employed in digging in the mines. The third began in the third year of Trajan, in the year 100, and was carried on with great violence for several years. The fourth was under Antoninus the philosopher, when the Christians were banished from their houses, forbidden to shew

their heads, reproached, beaten, hurried from place to place, plundered, imprisoned, and stoned. The fifth began in the year 197, under the emperor Severus. The sixth, began with the reign of the emperor Maximinus, in 235. The seventh, which was the most dreadful persecution that ever had been known in the church, began in the year 250, in the reign of the emperor Decius, when the Christians were in all places driven from their habitations, stripped of their estates, tormented with racks, &c. The eighth began in the year 257, in the fourth year of the reign of the emperor Valerian. The ninth was under the emperor Aurelian A. D. 274, but this was very inconsiderable; and the tenth began in the nineteenth year of Dioclesian, A. D. 303. In this dreadful persecution, which lasted ten years, houses filled with Christians were set on fire; and whole droves were tied together with ropes, and thrown into the sea.

**PERSEPOLIS**, formerly a city of Persia, but now in ruins. Here are the most magnificent remains of a palace, or temple, that are now in being on the face of the earth: E. long.  $54^{\circ}$ , N. lat.  $30^{\circ} 30'$ .

**PERSEUS**, in astronomy. See *ASTRONOMY*, p. 486.

**PERSIA**, a large kingdom of Asia, 1200 miles long, and almost as much broad; situated between  $45$  and  $67^{\circ}$  of E. long. and between  $25^{\circ}$  and  $45^{\circ}$  of N. lat. bounded by Circassian Tartary, the Caspian Sea, and the river Oxus, on the north; by India on the east; by the Indian Ocean, and the gulphs of Ormus and Persia, on the south; and by the Turkish empire on the west.

**PERSICA**, in botany. See *AMYGDALUS*.

**PERSICARIA**, in botany. See *POLYGONUM*.

**PERSON**, an individual substance of a rational or intelligent nature. Thus we say, an ambassador represents the person of his prince; and that, in law, the father and son are reputed the same person.

**PERSON**, in grammar, a term applied to such nouns or pronouns, as, being either prefixed or understood, are the nominatives in all inflections of a verb; or it is the agent or patient in all finite and personal verbs. See *GRAMMAR*.

**PERSONAL RIGHT**, in Scots law. See *LAW*, Tit. xx. 1.

**PERSONAL VERB**, in grammar, a verb conjugated in all the three persons; thus called, in opposition to an impersonal verb, or that which has the third person only.

**PERSONALITY**, in the schools, that which constitutes an individual or distinct person.

**PERSONIFYING**, the giving an inanimate being the figure, sentiments, and language of a person.

Personifying is essential to poetry, especially to the eponœia: the poets have therefore personified all the passions, and even represented them as deities; as the goddess Persuasion, the god Sleep; the Furies, Envy, Discord, and Fame, Fortune, Victory, Sin, Death, &c.

## P E R S P E C T I V E.

**PERSPECTIVE** teaches how to represent objects on a plane superficies, such as they would appear at a certain distance and height, upon a transparent plane perpendi-

cular to the horizon, placed between the objects and the eye.

In order to understand this subject, a general knowledge of the principles of Optics is absolutely necessary. The foundation

ation of perspective may be understood by supposing the pentagon ABDEF (Plate CXLIII. fig. 1.) were to be represented by the rules of perspective on the transparent plane VP placed perpendicularly on the horizontal plane HR; dotted lines are imagined to pass from the eye C to each point of the pentagon, as CA, CB, CD, &c. which are supposed in their passage through the plane PV to leave their traces or vestigia in the points *a, b, d, &c.* on the plane, and thereby to delineate the pentagon *abdef*; which, as it strikes the eye by the same rays that the original pentagon ABDEF does, will be a true perspective representation of it.

The business of perspective, therefore, is to lay down geometrical rules for finding the points *a, b, d, e, f*, upon the plane; and hence also we have a mechanical method of delineating any object very accurately.

Perspective is either employed in representing the ichnographies or ground plots of objects; or the scenographies, or representations of the objects themselves.

But before we give any examples of either, it will be proper to explain some technical terms in regard to perspective in general: and first, the horizontal line is that supposed to be drawn parallel to the horizon through the eye of the spectator; or rather it is a line which separates the heaven from the earth, and which limits the sight. Thus, A, B, (*ibid.* fig. 2.) are two pillars below the horizontal line CD, by reason the line is elevated above them; in fig. 3. they are said to be equal with it, and in fig. 4. raised above it. Thus, according to the different points in view, the objects will be either higher or lower than the horizontal line. The point of sight A (*ibid.* fig. 5.) is that which makes the central ray on the horizontal line *ab*; or, it is the point where all the other visual rays DD unite. The points of distance, C, C, are points set off in the horizontal line at equal distances on each side of the point of sight A; and in the same figure BB represents the base line, or fundamental line: EE is the abridgment of the square; of which D, D, are the sides; F, F, the diagonal lines, which go to the points of distance C. C. Accidental points are those where the objects end: these may be cast negligently; because neither drawn to the point of sight, nor to those of distance, but meeting each other in the horizontal line. For example, two pieces of square timber G and H (*ibid.* fig. 6.) make the points I, I, I on the horizontal line; but go not to the point of sight K, nor to the points of distance C, C; these accidental points serve likewise for casements, doors, windows, tables, chairs, &c. The point of direct view, or of the front, is when we have the object directly before us; in which case, it shews only the fore-side; and, if below the horizon, a little of the top; but nothing of the sides, unless the object be polygonous.

Thus the plan ABCD, (*ibid.* fig. 7.) is all in front, and if it were raised we should not see any thing of the sides AB or CD, but only the front AD: the reason is, that the point of view E being directly opposite thereto, causes a diminution on each side; which however is only to be understood where an elevation is the object; for if it be a plan, it shews the whole, as ABCD.

The point of oblique view, is when we see an object a-side of us, and as it were a-slant, or with the corner of the eye; the eye, however, being all the while opposite to the point of sight; in which case, we see the object laterally, and it presents to us two sides or faces.

For instance, if the point of sight be in F, (*ibid.* fig. 8.) the object GHIK will appear a-thwart, and shew two faces GK and GH, in which case it will be a side point.

We shall now give some examples, by which it will appear, that the whole practice of perspective is built upon the foundation already laid down. Thus, to find the perspective appearance of a triangle ABC (*ibid.* fig. 9.) between the eye and the triangle draw the line DE, which is called the fundamental line; from 2 draw 2 V, representing the perpendicular distance of the eye above the fundamental line, be it what it will; and through V draw, at right angles to 2 V, HK parallel to DE: then will the plane DHKE represent the transparent plane on which the perspective representation is to be made. Next to find the perspective points of the angles of the triangle, let fall perpendiculars A 1, C 2, B 3, from the angles to the fundamental DE: set off these perpendiculars upon the fundamental opposite to the point of distance K, to B, A, C; from 1, 2, 3, draw lines to the principal point V; and from the points A, B, and C, on the fundamental line, draw the right lines AK, BK, CK, to the point of distance K, which is so called, because the spectator ought to be so far removed from the figure or painting, as it is distant from the principal point V. The points *a, b, and c*, where the visual lines V 1, V 2, V 3 intersect the lines of distance AK, BK, CK, will be the angular points of the angle *abc*, the true representation of ABC.

To draw a square pavement in perspective. See fig. 10. and 11. of Plate CXLIII.

Suppose your piece of pavement to consist of 64 pieces of marble, each a foot square. Your first business is, to draw an ichnographical plan or ground-plot of it, which is thus performed. Having made an exact square of the size you intend your plan, divide the base and horizon into eight equal parts; and from every division in the base to its opposite point in the horizon, rule perpendicular lines: then divide the sides into the same number, ruling parallel lines across from point to point: so will your pavement be divided into 64 square feet; because the eight feet in length, multiplied by the same in breadth, give the number of square feet or pieces of marble contained in the whole: then rule diagonals from corner to corner; and thus will your ground-plot appear as in fig. 10.

Now, to lay this in perspective, draw another square to your intended size, and divide the base line AB into eight equal parts, as before; then fix your point of sight C in the middle of the horizon DE, and from the same point rule lines to every division in the base AB; after which, rule diagonal lines from D to B, and from E to A, answerable to those in the ground-plot, and your square will be reduced to the triangle ABC; then from the point F, where the diagonal DB intersects the line AC, to the opposite intersection G, where the diagonal EA crosses the line CB, rule a parallel line, which is the abridgment of the square.

Then through the points where the diagonals cross the rest of the lines which go from the base to the point of sight, rule parallel lines, and your square pavement will be laid in perspective, as in fig. 11.

To diminish a square viewed by the angle D. See Plate CXLIII. fig. 12.

Having described the plane ABCD, draw a line to touch



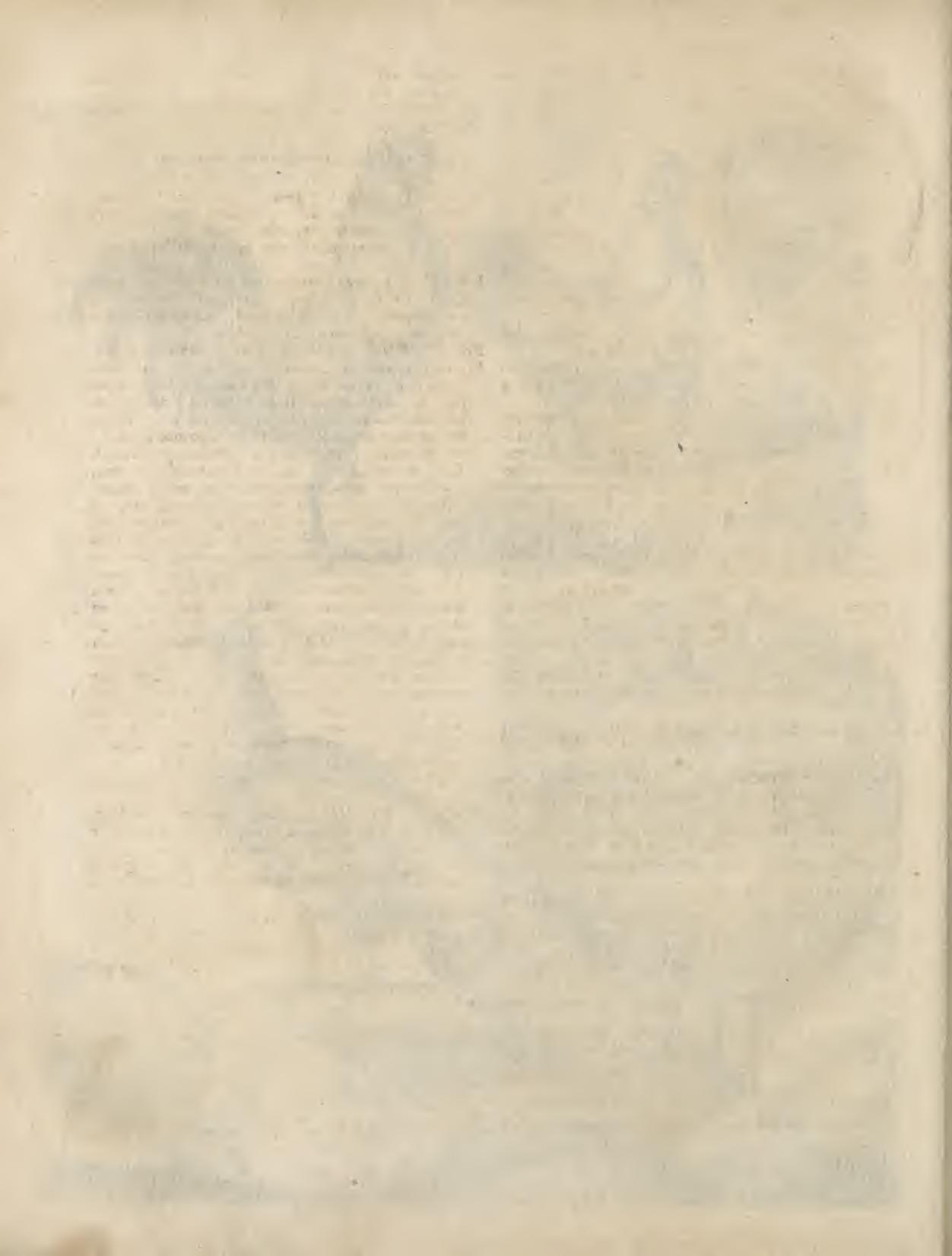
PILASIANUS GALLUS  
*or common Cock & Hen.*



PAVO CRISTATUS  
*or Peacock.*

*Hen.*

*A. Hall sculp.*



or raise the angle B, and falling perpendicularly on BD.

This being continued as a base line, lay your ruler on the side of the square AD and DC, and where the ruler cuts the terrestrial line make the points H, I.

Then from H and B draw lines to the point of distance P, and from I draw a line to the other point of distance G; and in the intersection of those lines, make points, which will give you the square KLMB.

To do without the plan: set off the diameter each way from the middle point B, as to H and I. But in either case no line is to be drawn to the point of sight O.

*To diminish a Circle.* See Plate CXLIII. fig. 13.

Draw a square ABCD about it, and from the angles AD and CB draw diagonals, dividing the circle into eight parts, and through the points where they cut it OO, draw lines from the base line perpendicular to DEF.

Then draw two diagonals QR, SP, intersecting each other at right angles in the centre G.

Having thus disposed the plan, draw lines from all the perpendiculars to the point of sight H; and where they are intersected by the diagonals AK and BI, make points; the two last of which M, N give the square, which is to be divided into four by diagonals, intersecting each other in the point P.

In the last place, from the extremes of this cross, draw curve lines through the said points, which will give the form of the circle in *perspective*.

*Of the measures upon the base in perspective,* Pl. CXLIV.

By the base line alone any depth may be given, and in any place at pleasure, without the use of squares; which is a very expeditious way.

As for example, suppose the base line BS, (fig. 1.) the point of view A, and the points of distance DE; if now you would make a plan of a cube BC, draw two occult or dotted lines from the extremes BC to the point of sight; then to give the breadth, take the same measure BC, and set it off on the terrestrial line CF, and from F draw a line to the point of distance D; and where this line intersects the first ray C in the point G, will be the diminution of the plan of the cube BHGC.

If you would have an object farther towards the middle, take the breadth, and the distance of the base line, as IK; and to have the depth, set it as you would have it on the same base as LM, and its width both on LM. Then from L and M draw occult lines to the point of distance D, and from the points NO, where those lines intersect the ray K, draw parallels to the terrestrial line, and you will have the square QPON.

After the same manner you may set off the other side of the square which should be on the base, as BHGC is here transferred to V. The points M and T, which are only two feet from the point S, afford a very narrow figure in K, as being very near.

*Of the base line, and a single point of distance.*

Since the depths and widths may be had by the means of this base line, there is no need of any further trouble in making of squares; as shall be shewn in this example.

Suppose a row of trees or columns is to be made on each side; on the base line lay down the place, and the distance between them, with their breadth or diameters, as ABC-

DEFG; then laying a ruler from the point of distance O to each of the points ABCDEFG, the intersections it makes on the visual ray AH will be the bounds of the objects desired. Fig. 2.

To set them off on the other side upon the ray GH, set one foot of the compasses upon the point of the eye H, and with the other strike an arch; the point wherein this cuts the ray GH, will be the corresponding bound.

Thus M will be the same with N, and so of the rest; through which drawing parallels, you will have the breadths.

And as for the length, you may make it at pleasure: setting it off from A, as for instance, to P, and then from P drawing a line to H; and where this cuts the other parallels, will be formed the plan required; which you may make either round or square.

*To find the height and proportion of any objects, as they appear above the horizon on a supposed plane.* See Plate CXLIV. fig. 3.

First rule your horizontal line NO, and fix your point of sight, as at M; then mark the place of your nearest pillar, by making a dot for the base or bottom, as at A; and another for the summit or top, as at B: rule a line from A to the point of sight M, and another from B to M, and these two lines will give the height of any number of pillars. As for example: Suppose you would have a pillar at C, fix your dot for the base, and rule from thence a parallel line to meet the diagonal AM at D: then rule the perpendicular DE to the diagonal BM: which perpendicular is the height of your figure required at C. Or, if you would place pillars at F and I, observe the same method, ruling the parallels FG and IK, and the perpendiculars GH and KL will give their heights at the distances required.

To find the diameter or thickness of pillars at any particular distances, you are also to be guided by that nearest the base. For instance: Suppose your nearest pillar AB to be ten feet high, and one foot in diameter: divide it from top to bottom into ten equal parts, and set off one of them upon the base of the pillar: then rule a line from the point of sight M to the diameter P, and you will have the thickness of all your pillars on their respective parallels or bases.

*The same rule exemplified in objects below the horizon.*  
See Plate CXLIV. fig. 4.

If you would know the heights of a number of figures below the horizon, rule your horizontal line QR, and fix your point of sight, as at P: then place your nearest figure, or mark the dots for the head and feet, by the points A and B, which answers the same purpose; and rule from these dots to the point of sight the lines AP and BP: and if you would find the height of a figure to be drawn at c, rule from thence the parallel cd to the diagonal BP, and the perpendicular de will give the height required. The same directions will shew the height of a figure at any other distance you have a mind to place it, as at f, i, and m, by ruling the parallels fg, ik, and mn; and from each of these their respective perpendiculars gh, kl, and no; which perpendiculars will shew the heights of the figures at f, i, and m.

4. *To draw a direct view.* See Plate CXLIV. fig. 4.

To illustrate this example, suppose you were to draw the inside of a church, as represented in this figure: First take your station at the point A, in the centre of the base line

BC: from which you have a front view of the whole body of the church, with all the pillars, &c. on each side: then fix your horizon at any height you think proper, as at DE: bisect it by the perpendicular EA: and where these two lines intersect, is the point of sight F. This perpendicular will pass through the centres of all the arches in the dome or cupola: which centres may be found by any three given points. Next divide your base line into any given number of feet; and the visual lines, ruled from these divisions to the point of sight, will reduce all your objects to their just proportion, by setting off their height upon a perpendicular raised at their respective distances. The base, in the example here given, is divided into twelve equal parts of five feet each; from which (supposing your front column to be 35 feet high) take seven divisions from the base line of your drawing, and set them off upon the perpendicular GH; then (supposing this column to be five feet thick at the base) set off one of those divisions upon the parallel IK, which is the breadth required. So that, by proportioning this scale to any distance by the foregoing directions, you may not only find the dimensions of all your columns, but also of every distinct part of them, as well as of all the doors, windows, and other objects that occur. For instance: Having found the height and breadth of your first or nearest column G, draw from the top and bottom of the said column to the point of sight the lines HF and KF; after which, rule the line IF from the base of the column to the point of sight, and you have the height and breadth of all the rest of the columns, as has been already shewn in fig. 3.

By ruling lines from the points *a, b, c, d*, &c. to the point of sight, you will see that all the summits and bases of your columns, doors, windows, &c. must tend immediately to that point; and by lines drawn from the points 1, 2, 3, 4, &c. on each side, to the correspondent points on the opposite side, may be seen all the parts of your building lying upon the same parallel.

*To draw an oblique view.* See fig. 6. of Plate CXLIV.

First draw your horizontal line AB; then, if your favourite object be on the right hand, as at C, place yourself on the left hand upon the base line, as at D; then from that station erect a perpendicular DE, which will pass through the horizon at the point of sight F; to which rule the diagonals GF and HF, which will shew the roof and base of your principal building C, and will also, as before directed, serve as a standard for all the rest.

Observe also, either in direct or oblique views, whether the prospect before you make a curve; for if it does, you must be careful to make the same curve in your drawing.

*To draw a perspective view, wherein are accidental points.*  
See fig. 7. of Plate CXLIV.

Rule your horizontal line *ab*, and on one part of it fix your point of sight, as at *c*; from which rule the diagonals *cd* and *ce* on the one side, and *cf* and *cg* on the other; which will shew the roofs and bases of all the houses in the street directly facing you; (supposing yourself placed at A in the centre of the base line:.) Then fix your accidental points *g* and *h* upon the horizontal line, and rule from them to the angles *ik* and *lm*, (where the streets on each side take a different direction, towards the accidental points *g* and *h*) and the lines *gi* and *gk* give the roofs and bases of all the buildings on one side, as *lh* and *mb* do on the other.

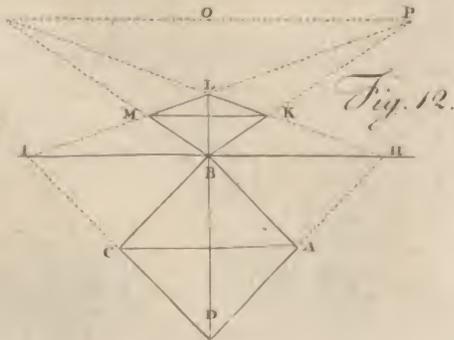
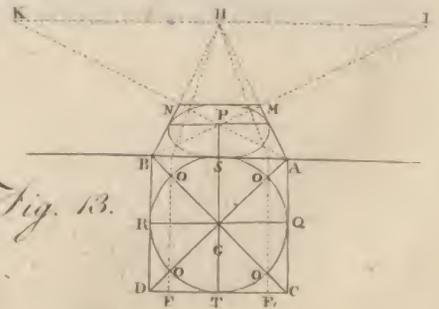
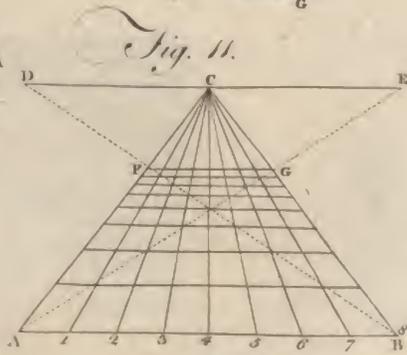
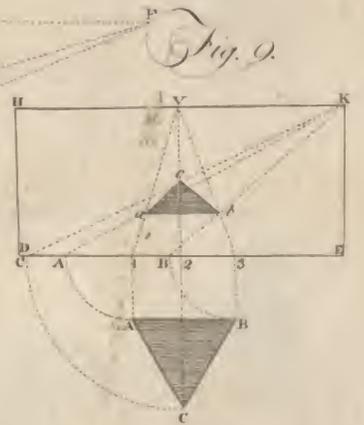
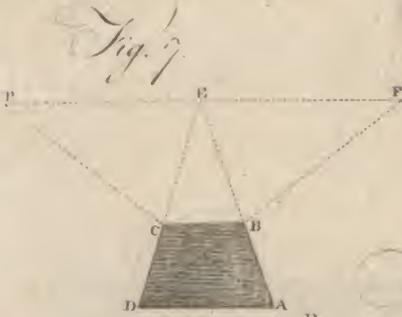
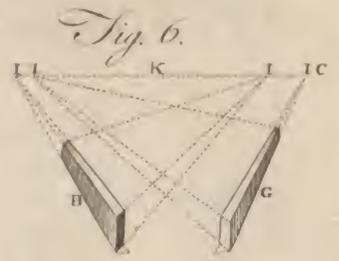
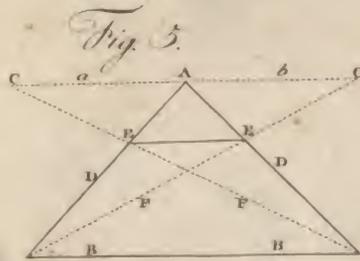
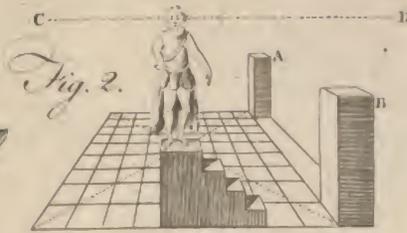
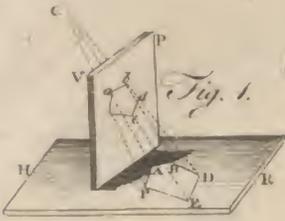
Accidental points seldom intervene where the distance is small, as in noblemens seats, groves, canals, &c. which may be drawn by the strict rules of perspective: but where the prospect is extensive and varied, including mountains, bridges, castles, rivers, precipices, woods, cities, &c. it will require such an infinite number of accidental points, that it will be better to do them as nature shall dictate, and your ripened judgment approve.

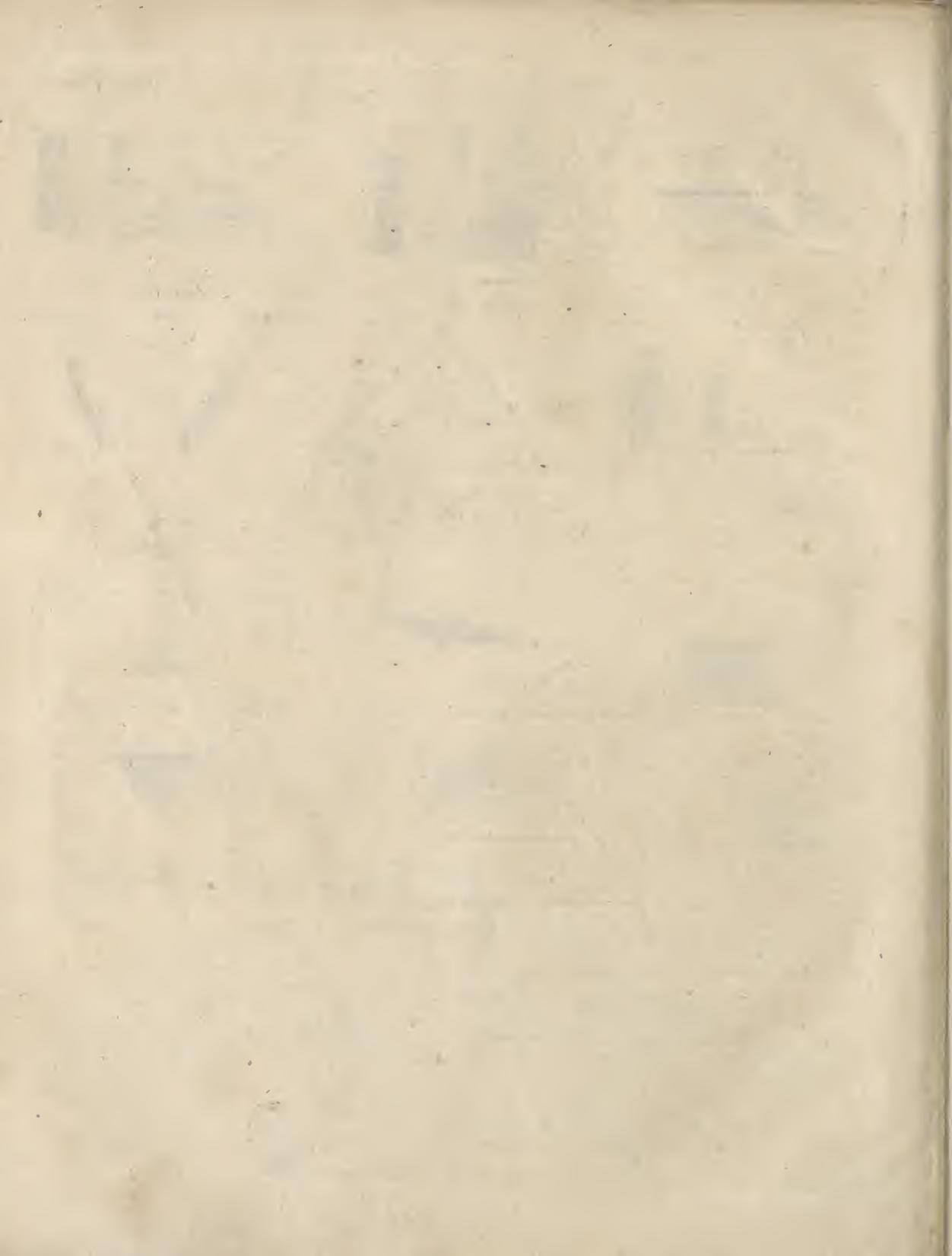
*To find the centre for the roof of a house, in an oblique view.*  
See fig. 8. of Plate CXLIV.

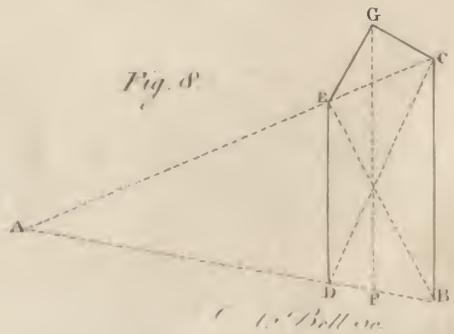
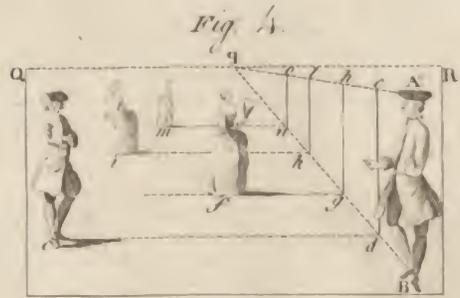
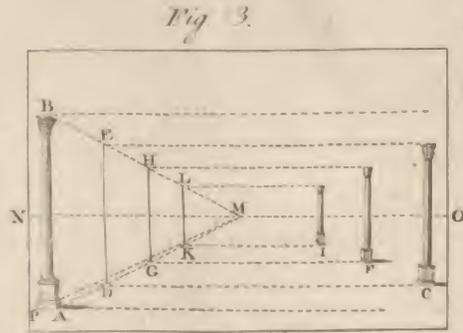
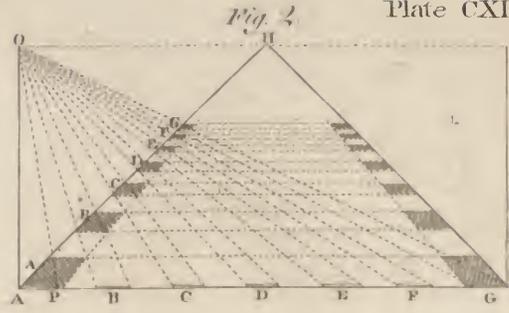
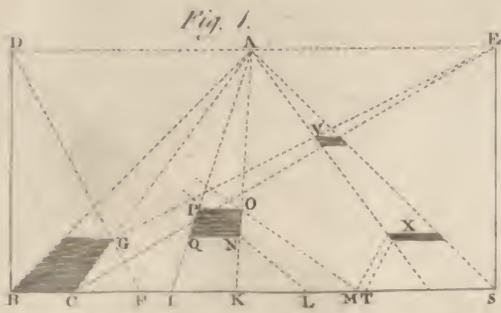
Suppose from the point of sight A, the visual lines AB and AC be drawn, BC being one perpendicular given, and DE the other, rule the diagonals from D to C, and from E to E, and the perpendicular FG, raised through the point of their intersection, will shew the true centre of the roof, as will appear by ruling the lines GE and GC.

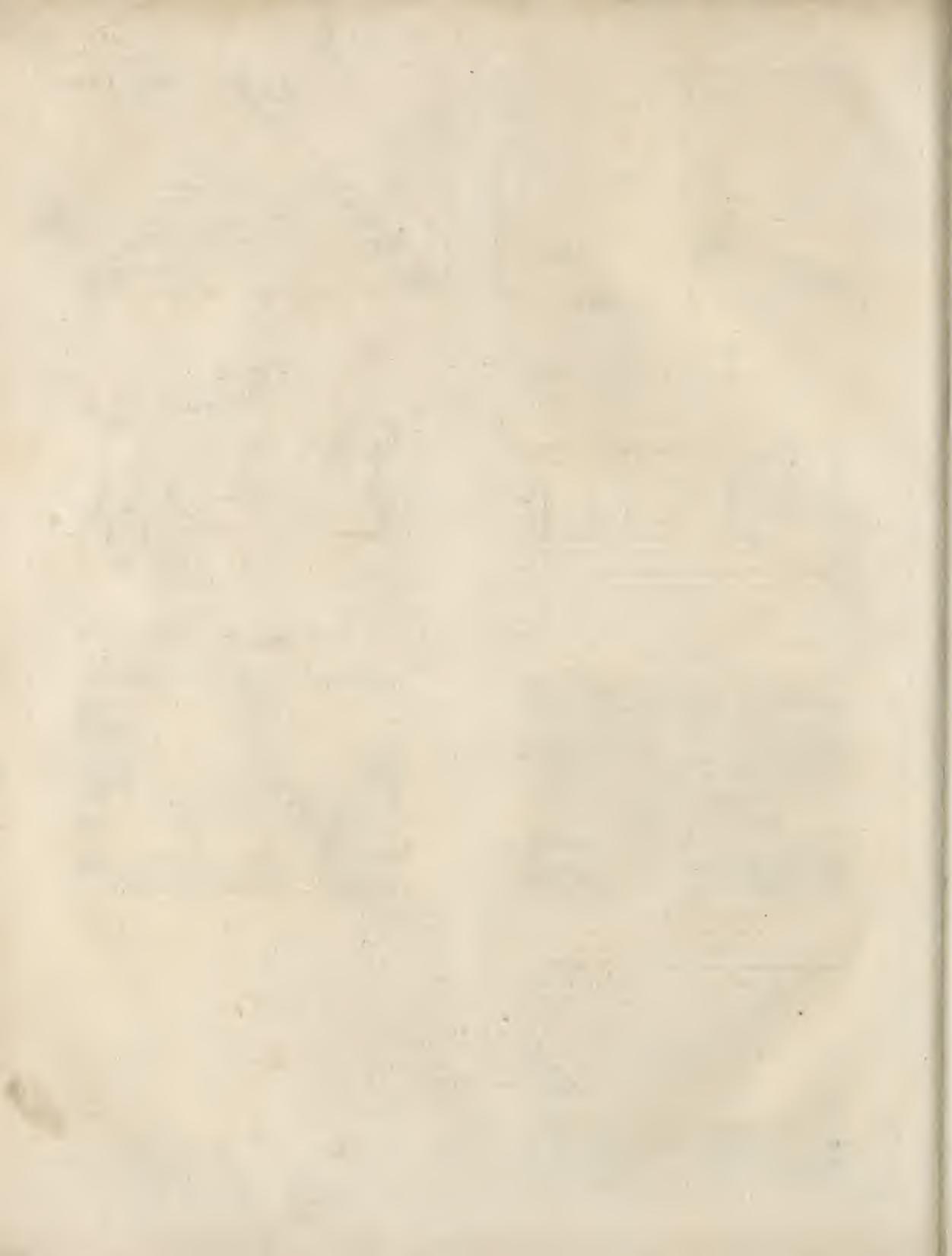
For want of being acquainted with this necessary rule, many who have been well versed in other parts of perspective, have spoiled the look of their picture, by drawing the roofs of their houses out of their true perpendicular.

WE shall conclude by giving a few practical rules. 1. Let every line, which in the object, or geometrical figure, is straight, perpendicular, or parallel to its base, be so also in its scenographic delineation. 2. Let the lines, which in the object return at right angles from the fore-right side, be drawn scenographically from the visual point. 3. Let all straight lines, which in the object return from the fore-right side, run in a scenographic figure into the horizontal line. 4. Let the object you intend to delineate, standing on your right-hand, be placed also on the right hand of the visual point; and that on the left-hand, on the left-hand of the same point; and that which is just before, in the middle of it. 5. Let those lines which are (in the object) equidistant to the returning line be drawn in the scenographic figure, from that point found in the horizon. 6. In setting off the altitude of columns, pedestals, and the like, measure the height from the base line upwards, in the front or fore-right side; and a visual ray down that point in the front shall limit the altitude of the column or pillar, all the way behind the fore-right side, or orthographic appearance, even to the visual point. This rule you must observe in all figures, as well where there is a front or fore-right side, as where there is none. 7. In delineating ovals, circles, arches, crosses, spirals, and cross-arches, or any other figure in the roof of any room, first draw ichnographically, and so with perpendiculars from the most eminent points thereof, carry it up unto the ceiling; from which several points, carry on the figure. 8. The centre in any scenographic regular figure is found by drawing lines from opposite angles: for the point where the diagonals cross, is the centre. 9. A ground-plane of squares is alike, both above and below the horizontal line; only the more it is distant above or beneath the horizon, the squares will be so much the larger or wider. 10. In drawing a perspective figure, where many lines come together, you may, for the directing of your eye, draw the diagonals in red; the visual lines in black; the perpendiculars in green, or other different colour, from that which you intend the figure shall be of. 11. Having considered the height, distance, and position of the figure, and drawn it accordingly, with side or angle against the base; raise perpendiculars from the several angles,









or designed points, from the figure to the base, and transfer the length of each perpendicular, from the place where it touches the base, to the base on the side opposite to the point of distance; so will the diametrals drawn to the perpendiculars in the base, by intersection with the diagonals, drawn to the several transferred distances, give the angles of the figures, and so lines drawn from point to point will circumscribe the scenographic figure. 12. If in a landscape there be any standing-waters, as rivers, ponds, and the like, place the horizontal line level with the farthest sight or appearance of it. 13. If there be any house, or the like, in the picture, consider their position, that you may find from what point in the horizontal lines to draw the front and sides thereof. 14. In describing things at a great distance, observe the proportion, both in magnitude and distance, in draught, which appears from the object to the eye. 15. In colouring and shadowing of every thing, you must do the same in your picture, which you observe with your eye, especially in objects lying near; but, according as the distance grows greater and greater, so the colours must be fainter and fainter, till at last they lose themselves in a darkish sky-colour. 16. The catoptrics are best seen in a common looking-glass, or other polished matter; where, if the

glass be exactly flat, the object is exactly like its original; but, if the glass be not flat, the resemblance alters from the original; and that more or less, according as the glass differs from an exact plane. 17. In drawing catoptric figures, the surface of the glass is to be considered, upon which you mean to have the reflection: for which you must make a particular ichnographical draught, or projection; which on the glass must appear to be a plane full of squares, on which projection transfer what shall be drawn on a plane, divided into the same number of like squares; where though the draught may appear very confused, yet the reflection of it on the glass will be very regular, proportional, and regularly composed. 18. The dioptric, or broken beam, may be seen in a tube through a crystal or glass, which hath its surface cut into many others, whereby the rays of the object are broken. For to the flat of the crystal, or water, the rays run straight; but then they break and make an angle, which also by the refracted beams is made and continued on the other side of the same flat. 19. When these faces on a crystal are returned towards a plane placed directly before it, they separate themselves at a good distance on the plane; because they are all directed to various far distant places of the same. See OPTICS.

## P E R

## P E S

**PERSPECTIVE GLASS**, in optics, differs from a telescope in this: instead of the convex eye-glass placed behind the image, to make the rays of each pencil go parallel to the eye, there is placed a concave eye-glass as much before it; which opens the converging rays, and makes them emerge parallel to the eye. See OPTICS.

**PERSPIRATION**, in medicine, the evacuation of the juices of the body through the pores of the skin. Perspiration is distinguished into sensible and insensible: and here sensible perspiration is the same with sweating, and insensible perspiration that which escapes the notice of the senses; and this last is the idea affixed to the word perspiration when used alone.

The matter of insensible perspiration, is a fine subtle fluid, which exhales from the body in the form of a vapour, and proceeds from the whole surface and from every cavity; it is of an aqueous and saline nature, and seems to have a great analogy with urine; because in a healthy state, the increase of the one diminishes the other. Many experiments prove its existence. Sanctorius found, in Italy, under the circumstances of a moderate diet, middle age, and easy life, that the matter insensibly perspired was five-eighths of that taken in for food; so that there only remained three-eighths for nutrition, and for the excrements of the nose, ears, intestines, bladder, &c. The same author shews, that as much is evacuated by perspiration in one day, as by stool in fourteen days.

But Dr. Bryan Robinson, of Dublin, has found the case very different, both in England and Ireland, and even in South Carolina; in all which places he found that the quantity of urine exceeds that of perspiration; and that if the meat and drink of one day be four pounds and a half, the perspiration of that day will be two pounds, the urine two pounds five ounces, and the stool three ounces.

The matter of sweat is separated from the blood by the miliary glands, and is therefore much more gross than that of insensible perspiration; for as there are no glands which serve for the excretion of this last fluid, it is supposed to proceed from the extremities of the capillary arteries.

The use of perspiration is to preserve the suppleness of the papillæ of the skin; to carry the saline particles off from the blood, and by this means to render it more pure; to preserve the body from various diseases; and to contribute to the cure of the most dangerous distempers. It may be promoted by exercise, by dry frictions with a coarse linen-cloth or a flesh-brush, by warm baths, and washing the hands, feet, head, &c.

**PERTH**, the capital of the county of the same name in Scotland, thirty miles north of Edinburgh.

**PERTHAMBOY**, a port-town of New-Jersey, in North America: W. long. 74°. N. lat. 40° 45'.

**PERTINENT OF LANDS**, in Scots law. See LAW, Tit. xiii. 18.

**PERU**, formerly a powerful empire in South America, but now a province of Spain, is situated between 60° and 81° of west longitude, and between the equator and 25° of south latitude, being near 2000 miles in length from north to south, and from 200 to 500 broad: it is bounded by Popayan, on the north; by the mountains of Andes, on the east; by Chili and La Plata, on the south; and by the Pacific Ocean, on the west.

**PERUGIA**, a city of Italy, in the territories of the pope: E. long. 13° 16', N. lat. 43°.

**PERUVIAN BARK**. See CINCHONA.

**PESARO**, a city of Italy, in the province of Urbino, situated on the gulph of Venice: E. long. 14°, N. lat. 44°.

**PESSARY**, in medicine, a solid substance composed of wool, lint, or linen, mixed with powder, oils, wax, &c. made.

made round and long like a finger, in order to be introduced into the exterior neck of the matrix, for the cure of several disorders incident to the uterus.

**PEST**, a city of upper Hungary, situated on the Danube: E. long. 19° 15', N. lat. 47° 42'.

**PES TILENCE**, in medicine. See **MEDICINE**, p. 71.

**PETAL**, among botanists. See **BOTANY**, p. 637.

**PETALISM**, in antiquity, a kind of banishment practised at Syracuse, by writing the person's name on a leaf; whence the name.

**PETARD**, in the art of war. See **GUNNERY**, p. 761.

**PETACITES**, in botany. See **TUSSILAGO**.

**PETECHIÆ**, in medicine, denotes spots in the skin like flea-bites, which come out in malignant fevers, hence called petechial or spotted fevers. See **MEDICINE**, p. 67.

**PETER**, or *Epistles of St. Peter*, two canonical books of the New Testament, written by the apostle St. Peter, and addressed to those Jewish converts who were scattered throughout Pontus, Galatia, &c. not only upon the persecution raised at Jerusalem, but upon former dispersions of the Jews into those places. The first of these epistles is principally directed to comfort and confirm them, under those fiery trials they were then subject to; and to direct them how to behave in the several states and relations, both of the civil and the Christian life. In the second epistle, the apostle prosecutes the same subject, to prevent their apostacy from the faith, and guard them against the corrupt principles of the gnostics, and those who insisted at the promise of Christ's coming.

**St. Peter's Day**, a festival of the Christian church, observed on the twenty-ninth of June.

**PETERBOROUGH**, a city of Northamptonshire, situated on the river Nen, thirty-four miles north-east of Northampton: W. long. 15', N. lat. 52° 53'. It sends two members to parliament.

**PETER-PENCE**, an ancient tax of a penny on each house, paid to the pope.

It was called peter-pence because collected on the day of St. Peter *ad vincula*, and sent to Rome; whence it was also called Rome-foot and Rome-penny.

**PEIERSBURG**, the capital city of Russia, and one of the largest and most populous cities in the world, situated on both sides the river Nieva, in the provinces of Carelia and Ingria, between the gulph of Finland and the lake of Ladoga: E. long. 31°, N. lat. 60°. There were no less than sixty-five thousand houses built within three or four years after the foundation was laid, which was in the year 1703.

**PETERSFIELD**, a borough-town of Hampshire, fifteen miles south-east of Winchester.

**PETERSHAGEN**, a town of Germany, in the circle of Westphalia and duchy of Minden, thirty-seven miles west of Hanover: subject to Prussia.

**PETHERTON**, a market-town of Somersetshire, 16 miles south-west of Wells.

**PETIOLE**, in botany, the slender stalks that supports the leaves of a plant.

**PETITGUAVES**, a port-town of Hispaniola, situated on a bay at the west end of the island: W. long. 76°, N. lat. 18° 5': subject to France.

**PETITIO PRINCÍPII**, in logic, the taking a thing for true, and drawing conclusions from it as such; when it

is really false, or at least wants to be proved, before any inferences can be deduced from it.

**PETITORY ACTION**, in Scots law. See **LAW**, Tit. xxx. 18.

**PETIVERIA**, in botany, a genus of the hexandria tetragynia class. The calix consists of four segments; it has no corolla; and but one seed with reflected prickles at the point. There are two species, none of them natives of Britain.

**PETRE**, or **SALT PETRE**. See **CHEMISTRY**, p. 73, 119.

**PETREA**, in botany, a genus of the didynamia angiospermia class. The calix is large, open, coloured, and divided into five segments; the corolla is open and rotated. There is but one species, a native of America.

**PETRIDIA**, in natural history, a genus of scrupi, of a plane, uniform structure, of no great variety of colours, and emulating the external form of pebbles.

**PETRIFICATION**, in physiology, denotes the conversion of wood, bones, and other substances into stone.

The fossil bodies found petrified are principally either of vegetable or animal origin, and are more or less altered from their original state, according to the different substances they have lain buried among in the earth; some of them having suffered very little change, and others being so highly impregnated with crystalline, sparry, pyritical, or other extraneous matter, as to appear mere masses of stone or lumps of the matter of the common pyrites; but they are generally of the external dimensions, and retain more or less of the internal figure of the bodies into the pores of which this matter has made its way.

The animal substances thus found petrified are shells; the teeth, bony palates, and bones of fish; the bones of land animals, &c. These are found variously altered, by the insinuation of stony and mineral matter into their pores; and the substance of some of them is now wholly gone, there being only stony, sparry, or other mineral matter remaining in the shape and form.

**PETROBRUSSIANS**, in church-history, a religious sect which arose in France and the Netherlands, about the year 1126, so called from their leader Peter Bruys. They denied that children, before the use of reason, can be justified by baptism. They also condemned all places of public worship, crosses, crucifixes; and are said to have rejected the sacrament of the eucharist, and prayers for the dead.

**PETROLEUM**, also called rock-oil, is an extremely subtle and penetrating fluid, and is much the thinnest of all the native bitumens. It is very light and very pellucid; but though equally bright and clear under all circumstances, it is liable to a very great variety in its colour. It is naturally almost colourless, and in its appearance greatly resembles the most pure oil of turpentine: this is called white petroleum, though it has no more colour than water; it is sometimes tinged of a brownish reddish, yellowish, or faint greenish colour; but its most frequent colour is a mixture of the reddish and blackish, in such a degree that it looks black when viewed behind the light, but purple when placed between the eye and a candle or window. It is of a pungent and acrid taste, and of a very strong and penetrating smell, which very much approaches to that of the distilled oil of amber. The white

is most esteemed. It is so very inflammable, that while it floats on the surface of the water, as it does in many parts of Italy, it takes fire at the approach of a candle.

Petroleum is found in rivers, in wells, and trickling down the sides of hills along with little streams of water. In short, it is the most frequent of all the liquid bitumens, and is perhaps the most valuable of them all in medicine. It is to be chosen the purest, lightest, and most pel'ucid that can be had, such as is of the most penetrating smell, and is most inflammable.

It is principally used externally, in paralytic cases, and in pains of the limbs.

**PETROMYZON**, in ichthyology, a genus belonging to the amphibia nantes class. It has seven spiracula at the side of the neck, no gills, a fistula on the top of the head, and no breast or belly fins. There are three species, distinguished by peculiarities in the back-fins.

**PETROSA OSSA**, in anatomy. See **ANATOMY**, p. 295, &c.

**PETTAW**, a city of Germany, in the circle of Austria : E. long 16° 8', N. lat. 47°.

**PETTIPOLI**, a port-town on the coast of Cormandel, in the hither India, where the Dutch have a factory : E. long 80°, N. lat. 16° 45'.

**PETUNSE**, in natural history, one of the two substances whereof the porcelain or china-ware is made.

The petunse is a coarse kind of flint or pebble, the surface of which is not so smooth, when broken, as that of our common flint.

**PEUCEDANUM**, in botany, a genus of the pentandria digynia class. The fruit is oval, streaked on each side, and surrounded with a wing; and the involucre is very short. There are five species, two of them natives of Britain, viz. the officinale, or hogs-fennel, the root of which is recommended in disorders of the breast; and the minus, or rock-parsley.

**PEWTER**, a facitious metal, used in making domestic utensils, as plates, dishes, &c.

The basis of this metal is tin, which is converted into pewter, by mixing at the rate of an hundred weight of tin with fifteen pounds of lead and six pounds of brass. See **METAL**.

Besides this composition, which makes the common pewter, there are other kinds compounded of tin, regulus of antimony, bismuth and copper, in several proportions.

**PEZIZA**, in botany, a genus of the cryptogamia fungi class. It is sessile and bell shaped. There are eight species, six of them natives of Britain.

**PHACA**, in botany, a genus of the diadelphia decandria class. The legumen or pod is somewhat bilocular. There are three species, none of them natives of Britain.

**PHENOMENON**, in philosophy, denotes any remarkable appearance, whether in the heavens or on earth; and whether discovered by observation or experiments.

**PHAGEDÆNA**, denotes a corroding ulcer.

**PHAGEDÆNIC MEDICINES**, those used to eat of fungus or proud flesh; such are all the caustics.

**PHALÆNA**, in zoology, a genus of insects belonging to the order of lepidoptera. The feelers are setaceous, and taper gradually to the points; the wings are often bent backwards; and the species of this genus fly about in the

night. There are no less than 460 species, comprehending all the moths.

**PHALANGIUM**, in zoology, a genus of insects belonging to the order of aptera. They have eight feet, two eyes on the top of the head placed very near each other, and other two on the sides of the head; the feelers resemble legs; and the belly is round. There are nine species.

**PHALANGIUM**, in botany. See **ANTHERICUM**.

**PHALANX**, in Grecian antiquity, a square battalion, consisting of eight thousand men, with their shields joined, and pikes crossing each other; so that it was next to impossible to break it.

**PHALARIS**, in botany, a genus of the triandria digynia class. It has two carinated valves, of equal lengths, and including the corolla. There are 10 species, three of them natives of Britain, viz. the canariensis, or manured canary-grass; the arenaria, or sea canary-grass; and the arundinacia, or reed canary-grass.

**PHALEUCIAN VERSE**, in ancient poetry, a kind of verse which consists of five feet, the first of which is a spondee, the second a dactyl, and the three last trochees.

**PHALLUS**, in botany, a genus of the cryptogamia fungi class. It is woven like a net above, and smooth below. There are two species, both natives of Britain, viz. the esculentus, or esculent morel; and the impudicus, or stinking morel.

**PHANATIC**, or **FANATIC**, a term of reproach formerly given to the dissenters, from a false supposition that they pretended to visions, &c.

**PHANTASM**, a term sometimes used in a synonymous sense with idea, or the notion retained in the mind of an external object.

**PHARISEES**, a famous sect of the Jews, who distinguished themselves by their zeal for the traditions of the elders, which they derived from the same fountain with the written word itself; pretending that both were delivered to Moses from Mount Sinai, and were therefore both of equal authority. From their rigorous observance of these traditions, they looked upon themselves as more holy than other men, and therefore separated themselves from those whom they thought sinners or prophane, so as not to eat or drink with them; and hence, from the Hebrew word *pharis*, which signifies to separate, they had the name of Pharisees or Separatists.

**PHARMACY**, the art which teaches the election, preparation, and mixture of medicines; constituting one part of the therapeutic branch of medicine, the objects of which are all natural bodies.

**PHARNACEUM**, in botany, a genus of the pentandria trigynia class. The calix consists of five leaves; it has no corolla; and the capsule has three cells, containing many seeds. There are five species; none of them natives of Britain.

**PHAROS**, a small island in the mediterranean sea, opposite to Alexandria, in Egypt.

**PHAROS**, or **PHARE**, a LIGHT-HOUSE, a pile raised near a port, where fire is kept burning in the night, to guide and direct vessels near at hand.

**PHARSALUS**, a town of ancient Thessaly, situated in European Turkey, a little south of Larissa, in E. lon. 23°, and N. lat. 39°.

**PHARYNX**, in anatomy. See **ANATOMY**, p. 302.

**PHASCUM**, in botany, a genus of the cryptogamia musci class. The antheræ are operculated, and the calyptra is wanting. There are four species, all natives of Britain.

**PHASEOLOUS**, in botany, a genus of the diadelphia decandria class. The carina, stamina, and stylus, are twisted like a screw. There are 13 species, none of them natives of Britain.

**PHASES**, in astronomy, the several appearances or quantities of illumination of the moon, venus, mercury, and the other planets. See **ASTRONOMY**.

**PHASIANUS**, in ornithology, a genus belonging to the order of gallinæ. The cheeks are covered with a smooth naked skin. There are six species, viz. 1. The gallus, or dunghill cock and hen, with a compressed caruncle or fleshy-comb on the top of the head, and a couple of caruncles or wattles under the chin; the ears are naked; and the tail is compressed, and erected. This bird, though now one of the domestic fowls, was originally brought from the East-Indies. They feed upon grain, grass-seeds, and worms. The cock or male is perhaps the boldest and most heroic of all the feathered tribe. He claps his wings before he sings or crows. He begins to crow about midnight, and seldom ceases till break of day. He is so exceedingly falacious, that one cock is sufficient for 10 hens. His sight is very piercing, and he never fails to cry in a peculiar manner when he discovers any bird of prey in the air. The hen is very prolific: she makes her nest on the ground; and the young immediately after they are hatched, follow her, and pick up their food themselves. There are six or eight varieties of this species. 2. The motmot, or Guinea pheasant, is brownish, somewhat red below, with a wedge-like tail, and wants spurs. It is a native of Guinea and Brasil. 3. The colchicus, is red, with a blue head, a wedge-shaped tail, and papillous cheeks. It is a native of Asia. 4. The argus is yellowish, with black spots, a red face, and a blue crest on the back part of the head. It is found in Chinese Tartary. 5. The pictus, has a yellow crest, a red breast, and a wedge-shaped tail. It is a native of China. 6. The nyctemerus, is white, with a black crest and belly, and a wedge-shaped tail. It is a native of China. See **PLATE CXLII**.

**PHASMATA**, in physiology, certain appearances arising from the various tinctures of the clouds, by the rays of the heavenly luminaries, especially the sun and moon. These are infinitely diversified by the different figures and situation of the clouds, and the appulses of the rays of light.

**PHASSACHATES**, in natural history, the name of a species of agate, which the ancients, in its different appearances, sometimes called also leucachates and perileucos. See **AGATE**.

**PHASANT**, in ornithology. See **PHASIANUS**.

**PELLANDRIUM**, in botany, a genus of the pentandria digynia class. The fruit is oval and smooth. There are two species, one of them, viz. the aquaticum, or water hemlock, is a native of Britain.

**PHELYPÆA**, in botany. See **LATHRÆA**.

**PHENICIA**, a subdivision or province of Syria, situated on the Levant, or eastern part of the Mediterranean sea, on the confines of Palestine.

**PHEONS**, in heraldry, the barbed heads of darts, arrows,

or other weapons; and usually represented as in **PLATE CXLV**, fig. 1.

**PHIDITIA**, in Grecian antiquity, feasts celebrated with great frugality at Lacedæmon. The phiditia were held in the public places, and in the open air: rich and poor assited at them alike, and on the same footing; their design being to keep up peace, friendship, and a good understanding and equality among all the citizens, great and small. It is said, that they who attended this feast, brought each a bushel of flour, eight measures of wine named chorus, five minæ of cheese, and as much figs.

**PHILADELPHIA**, the capital of the province of Pennsylvania, in North America, situated on the rivers Delaware and Schoolkill: W. long. 74°, N. lat. 40° 50'.

**PHILADELPHIA** is also the name of an ancient town of the Lesser Asia, situated in E. long. 29°, N. lat. 38°.

**PHILADELPHUS**, in botany, a genus of the icofandria monogynia class. The calix consists of four or five segments, and the corolla of four or five petals; and the capsule has four or five cells, containing many seeds. There are two species, none of them natives of Britain.

**PHILIP-FORT**, a fortress in Dutch Brabant, situated on the east side of the Scheld, opposite to Pearl-fort, five miles north-west of Antwerp.

**PHILIPPI**, an ancient town of Macedonia, a province of European Turkey, situated in E. long. 25°, N. lat. 41°.

**PHILIPPICS**, in literature, a name given to the orations of Demosthenes against Philip king of Macedon; being esteemed the master pieces of that great orator.

Philippic is also a term applied to the fourteen orations of Cicero against Mark Anthony.

**PHILIPPINE ISLANDS**, are situated in the Pacific ocean, in Asia, between 114° and 131° east longitude, and between 5° and 19° north latitude: there are a great number of them, and some very large.

**PHILIPPINES**, a religious society of young women, at Rome; so called from their taking St. Philip de Neri for their protector: they consist of an hundred poor girls, who are brought up till they are of age to be married, or become nuns, under the direction of some religious women, who teach them to read, write, and work; and instruct them in the duties of Christianity. They wear a white veil, and a black cross on their breasts.

**PHILIPPOPOLI**, a city of European Turkey, in the province of Romania, situated on the river Mariza: in E. long. 25°, and N. lat. 42° 20'.

**PHILIPSBURGH**, a city of Germany, in the palatinate of the Rhine, situated on the east bank of the river Rhine, in E. long. 8° 16', N. lat. 49° 8'.

**PHILIPSTAT**, a town of Sweden, in the province of Gothland and territory of Wermeland, situated in E. long. 14°. N. lat. 59° 50'.

**PHILLYREA**, in botany, a genus of the diandria monogynia class. The corolla consists of four segments, and the berry contains four seeds. There are three species, none of them natives of Britain.

**PHILOLOGY**, a science, or rather assemblage of several sciences, consisting of grammar, rhetoric, poetry, antiquities, history, and criticism.

Phylogy is a kind of universal literature, conversant about all the sciences, their rise, progress, authors, &c. It makes what the French call the *belles lettres*.

**PHILOMATHES**, a lover of learning or science.

**PHILONIUM**,

**PHILONIUM**, in pharmacy, a kind of fominiferous anodyne opiate, taking its name from Philo the inventor.

**PHILOSOPHER**, a person versed in philology; or one who makes profession of, or applies himself to, the study of nature and morality.

**PHILOSOPHER'S STONE**, the greatest object of alchymy, is a long sought for preparation, which, when found, is to convert all the true mercurial part of metal into pure gold, better than any that is dug out of the mines, or perfected by the refiner's art; and this only by casting a little quantity thereof upon metals in fusion, whilst that part of the metal which was not mercury is immediately burnt or blown away. But this like every other scientific chimera, will for ever elude the researches of mankind.

**PHILOSOPHIC**, or **PHILOSOPHICAL**, something that relates to philology. See **PHILOSOPHY**.

**PHILOSOPHICAL EGG**, among chemists, a thin glass-body, or bubble, of the shape of an egg, with a long neck or stem, used in digestions.

**PHILOSOPHY**, the knowledge or study of nature and morality, founded on reason and experience. See **MECHANICS**, **OPTICS**, **ASTRONOMY**. **LOGIC**, **MORALS**, &c.

**PHILYLCA**, in botany, a genus of the pentandria monogynia class. The perianthium is turbinated, and divided into five segments; it has no petals, but five scales fortifying the stamina. There are six species, none of them natives of Britain.

**PHIMOSIS**, in medicine, a disorder of the penis, in which the prepuce is rendered so strict or tense, that it cannot be drawn back over the glans. See **MEDICINE**.

**PHLEBOTOMY**, the opening a vein with a proper sharp-edged and pointed instrument of steel, in order to let out a proper quantity of blood, either for the preservation or recovery of a person's health.

**PHLEGM**, in the animal œconomy, one of the four humours whereof the ancients supposed the blood to be composed.

The chemists make phlegm, or water, an elementary body, the characters of which are fluidity, inspidity, and volatility.

**PHLEGMAGOGUES**, in pharmacy, such medicines as purge off phlegm: such are thermodactyls, agaric, turbit, jalap, &c.

**PHLEGMATIC**, among physicians, an appellation given to that temperament or habit of the body, wherein phlegm is predominant; which gives rise to catarrhs, coughs, &c.

**PHLEGMON**, denotes an external inflammation and tumour, attended with a burning heat, &c.

**PHLEUM** in botany, a genus of the triandria digynia class. The calix consists of two linear, truncated valves; there are five species, three of them natives of Britain, viz the pratense, or meadow cat's-tail-grass; the paniculatum, or branched cat's-tail-grass; and the nodosum, or bulbous cat's-tail-grass.

**PHLOGIDIAUGIA** a class of fossils, the characters of which are, that the bodies comprehended in it are transparent and inflammable: such are sulphur, orpiment, zarnick, and amber.

**PHLOGISCERIA**, another class of fossils, which are inflammable bodies of a coarser and more impure texture,

and not pellucid: such are ambergrease, jet, asphalt, anpeltites, and lithantrax.

**PHLOGISTON**. See **CHEMISTRY**, p. 68.

**PHLOGONIÆ**, a class of compound, inflammable, and metallic fossils, found in small masses of determinately angular figures; comprehending the pyricubia, pyroctogonia, and pyripolygonia.

**PHLOMIS**, in botany, a genus of the didynamia gymnospermia class. The calix is angular; and the superior lip of the corolla is compressed, incumbent, and hairy. There are twelve species, none of them natives of Britain.

**PHLOX**, in botany, a genus of the pentandria monogynia class. The corolla is shaped like a jug; the filaments are unequal; the stigma is trifid; and the capsule has three cells, and contains but one seed.

**PHLYCTÆNÆ**, in medicine, small eruptions on the skin.

**PHOCA**, in zoology, a genus of quadrupeds of the order of the feræ. It has six parallel fore-teeth in the upper jaw, the outermost being larger; and four blunt, parallel, distinct, equal fore-teeth in the under jaw: It has but one dog-tooth, and five or six three pointed grinders; and the hind-feet are united so as to resemble a fish's tail. There are three species, viz 1. The ursina, or sea-bear, has external ears. This animal swims with incredible swiftness: The males have often 120 females, sons, and daughters, in their train. They copulate on the shore, the female lying on their backs. They are hardly afraid of men, and bite stones when thrown at them. Each has a particular stone for his bed, which they seldom desert. They often fight for their wives and beds; when one is beat off, another makes a fresh attack, and thus succeed alternately, two never attacking one, till the whole be engaged, when they make a hideous wailing noise. They are found in the northern seas. 2. The leonina, or sea-lion, has a crest on his forehead. They are found near the south pole. They swim in troops, and fight for their wives. 3. The vitulina, or sea-calf, has a smooth head, without external ears. They inhabit the European ocean. They generally sleep upon stones above the water, and are easily killed by a stroke above the nose.

**PHOCEA**, a city of Ocolis, on the west coast of the lesser Asia, anciently so called.

**PHOENICOPTERUS**, or **FLAMINGO**, in ornithology, a genus of birds belonging to the order of grallæ. The beak is naked, teethed, and bent as if it were broken; and the nostrils are linear; and the feet are palmated, and four-toed. There is but one species, a native of Africa and America.

**PHOENIX**, in astronomy. See **ASTRONOMY**, p. 487.

**PHOENIX**, the **GREAT PALM**, or **DATE-TREE**, in botany, a genus of plants, the characters of which are not yet perfectly ascertained: the male and female flowers are on distinct plants, or on the same spadix.

**PHOLAS**, a genus of insects belonging to the order of vermes testacea. The shell is double-valved and divaricated; the cardo is turned backwards, and connected by a cartilage. There are six species, distinguished by the figure of their shells.

**PHONICS**, the doctrine or science of sounds, otherwise called acoustics. See **PNEUMATICS**.

**PHOSPHORUS**. See **CHEMISTRY**, p. 123,

**PHRENES**,

**PHRENES**, in anatomy. See **ANATOMY**, p. 253.

**PHRENSY**, in medicine, an inflammation of the membranes of the brain, attended with an acute fever and delirium. See **MEDICINE**, p. 88.

**PHRYGIA**, the Greater and Lesser, two provinces anciently of Asia Minor; having the Hellespont on the north.

**PHTHIRIASIS**, in medicine, the pedicularis morbus, or lousy disease, is most incident to children, though adults are not wholly exempt from it.

**PHTHISIS**, a species of consumption, arising from an ulcer of the lungs. See **MEDICINE**, p. 103.

**PHYLLANTHUS**, in botany, a genus of the monoechia triandria class. The calix both of the male and female consists of eight segments; neither of them have any corolla; the female has three bifid styli; the capsule has three cells, and contains one seed. There are six species, none of them natives of Britain.

**PHYLLIS**, in botany, a genus of the pentandria digynia class. The stigmata are rough; and the fruit is sparse. There are two species none, of them natives of Britain.

**PHYSALIS**, in botany, a genus of the pentandria monogynia class. The corolla is rotated; the seeds are connivent; and the berry has two cells, and is contained within an inflated calix. There are ten species, none of them natives of Britain.

**PHYSETER**, in zoology, a genus belonging to the order of Cete. It has teeth in the under jaw, and a fistula in the head or snout. There are four species, *viz.* 1. The catodon, with a fistula in the snout, and having no back-fin. 2. The macrocephalus has a fistula in the neck, and no back-fin. The spermaceti is extracted from the ventricles of its brain. 3. The microps, with a long fin on the back, and the upper jaw much longer than the under one. 4. The turpis, with a very high fin on the back; and the points of the teeth blunt. All the four species are inhabitants of the northern Ocean.

**PHYSIC**. See **MEDICINE**.

**PHYSICAL**, something relating to nature.

**PHYSICIAN**, a person who professes medicine, or the art of healing diseases.

**PHYSICS**, a denomination sometimes given to natural philosophy.

**PHYSIOLOGY**, properly denotes a discourse of nature, and natural bodies; or, it is that part of natural philosophy which treats of the various phenomena of nature in a scientific and speculative way.

Among physicians, the term physiology denotes the history of the human body and its several constituent parts, with their relations and functions.

**PHYTEUMA**, in botany, a genus of the pentandria monogynia class. The corolla is rotated, with linear lacinia; the stigma is trifid; and the capsule has two or three cells. The species are six, only one of them, *viz.* the orbicularis, or horned rampions, a native of Britain.

**PHYTOLACCA**, in botany, a genus of the decandria decagynia class. It has no calix; the petals are five; and the berry has ten cells, and ten seeds. There are four species, none of them natives of Britain.

**PHYTOLOGY**, a discourse concerning the kinds and virtues of plants.

**PIA MATER**, in anatomy. See **ANATOMY**, p. 285.

**PICA**, in ornithology. See **CORVUS**.

**PICA**, in medicine, a deprivation of appetite, which makes

the patient long for what is unfit for food, or incapable of nourishing, as chalk, ashes, coals, plaster, lime, &c.

**PICÆ**, the name of a class of birds. See **NATURAL HISTORY**.

**PICARDY**, a province of France, bounded by the French Netherlands, and the straits of Dover, on the north and east; by the isle of France, on the south; and by Normandy, and the English channel, on the west.

**PICKLE**, a brine or liquor, commonly composed of salt, vinegar, &c. sometimes with the addition of spices; wherein meat, fruit, and other things are preserved and seasoned.

**PICKERY**, in Scots law, petty theft, or stealing things of small value.

**PICQUERING**, a flying war or skirmish made by soldiers detached from two armies for pillage, or before a main battle begins.

**PICRIS**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; the calix is calciculated; the pappus is feathery; and the seeds are furrowed transversely. There are four species, two of them natives of Britain, *viz.* the echioides, or ox's tongue; and the hieracioides, or yellow fuccory.

**PICTS WALL**, in antiquity, a wall begun by the emperor Adrian, on the northern bounds of England, to prevent the incursions of the Picts and Scots. It was first made only of turf, strengthened with palisadoes, till the emperor Severus coming in person into Britain built it with solid stone. This wall, part of which still remains, begun at the entrance of Solway-frith in Cumberland, and running N. E. extended to the German ocean.

**PICTURE**, a piece of painting, or a subject represented in colours, on wood, canvas, paper, or the like.

**PICUS**, the **WOOD-PECKER**, in ornithology, a genus belonging to the order of picæ. The beak is 'strait, and consists of many sides, and like a wedge at the point; the nostrils are covered with bristly feathers; the tongue is round like a worm, very long, sharp at the point, which is beset with bristles bent backwards. There are 21 species, distinguished by their colour.

**PIECE**, in heraldry, denotes an ordinary or charge. See **CHARGE**.

**PIEDMONT**, a principality of Italy, so called from its lying at the foot of the Alps. It is bounded by Savoy, from which it is separated by the Alps, on the north; by the duchies of Milan and Montserrat, on the east; by the territories of Genoa, and the county of Nice, on the south; and by France, on the west; being about 100 miles long, and 70 broad.

**PIER**, in building, denotes a mass of stone, &c. opposed by way of fortrefs against the force of the sea, or a great river, for the security of ships that lie at harbour in any haven.

**PIETISTS**, a religious sect sprung up among the protestants of Germany, seeming to be a kind of mean between the quakers of England, and the quietists of the Romish church.

**PIG**, in zoology. See **SUS**.

**Guinea-PIG**. See **MUS**.

**PIG of lead**, the eighth part of a fother, amounting to two hundred and fifty pounds weight.

**PIGEON**, in ornithology. See **COLUMBA**.

**PIGMENTS**, preparations used by painters, dyers, &c. to impart

impart colours to bodies, or to imitate particular colours.

**PIGUS**, in ichthyology. See **CYPRINUS**.

**PIKE**, in ichthyology. See **LUCIUS**.

**PILLASTER**, in architecture. See **ARCHITECTURE**, p.

353.

**PILCHARD**, in ichthyology. See **CLUPEA**.

**PILE**, in heraldry, an ordinary in form of a wedge, contracting from the chief, and terminating in a point towards the bottom of the shield. See **PLATE CXXXIV.** fig. 16.

The pile, like other ordinaries, is borne inverted, ingrailed, &c. and issues indifferently from any point of the verge of an escutcheon.

**PILES**, in medicine. See **MEDICINE**, p. 143.

**PILGRIMAGE**, a kind of religious discipline, which consists in taking a journey to some holy place, in order to adore the relics of some deceased saint. Pilgrimages began to be made about the middle ages of the church; but they were most in vogue after the end of the eleventh century, when every one was for visiting places of devotion, not excepting kings and princes themselves; and even bishops made no difficulty of being absent from their churches on the same account. The places most visited were Jerusalem, Rome, Compostella, and Tours; but the greatest numbers now resort to Loretto, in order to visit the chamber of the blessed virgin, in which she was born, and brought up her son Jesus, till he was twelve years of age.

**PILL**, in pharmacy, a form of medicine resembling a little ball, to be swallowed whole, invented in favour of such as cannot take bitter and ill-tasted medicinal draughts, as also to keep in readiness for occasional use without decaying.

**PILLAR**, in architecture, a kind of irregular column, round and insulated, but deviating from the proportions of a just column. See **ARCHITECTURE**.

**PILLORY**, was anciently a post erected in a cross road, by the lord of the manor, with his arms upon it, as a mark of his feignory, and sometimes with a collar to fix criminals to.

**PILOT**, a person employed to conduct ships over bars and sands, or through intricate channels, into a road or harbour.

**PIMENTO**, in botany. See **MYRTUS**, of which it is a species.

The fruits are gathered when green, and are exposed to the sun for many days on cloths, frequently shaking and turning them, till thoroughly dry; they take great care they are not wetted by the morning and evening dews: and when thus dried, are sent over to us.

Pimento abounds with a fragrant essential oil, which is separated, in great quantity, in distillation; and is so heavy that it sinks in water. This spice is much used in our foods, and sometimes in medicine: it is, indeed, a very good aromatic, and so well imitates the mixed flavour of all the rest, that it has long been a common practice to make the aqua mirabilis, which was ordered to be distilled from all the spices, of this ingredient alone; and the taste of the water thus made, when carefully done, is so near the genuine, that a very nice palate can only distinguish it.

**PIMP NELLA**, in botany, a plant of the pentandria digynia class. The fruit is oblong; and the corolla is feb-

radiated. There are four species, two of them natives of Britain, viz. the major, or great burnet saxifrage; and the saxifraga, or small burnet saxifrage.

**PIN**, in commerce, a little necessary implement made of brass-wire, used chiefly by the women in adjusting their dresses.

The perfection of pins consists in the stiffness of the wire and its whiteness, in the heads being well turned, and in the fineness of the points. The London pointing and whitening are in most repute; because our pin-makers, in pointing, use two steel-mills, the first of which forms the point, and the latter takes of all irregularities, and renders it smooth, and as it were polished; and in whitening, they use block-tin granulated; whereas in other countries they are said to use a mixture of tin, lead, and quick silver.

**PINDARIC**, in poetry, an ode formed in imitation of the manner of Pindar.

**PINE**, in botany. See **PINUS**.

**PINE-APPLE**. See **BROMELIA**.

**PINEAL GLAND**, in anatomy. See **ANATOMY**, p. 286.

**PINGUICULA**, in botany, a genus of the diandria monogynia class. The corolla is ringent; the calix is bilabiated; and the capsule has but one cell. There are four species, two of them natives of Britain, viz. the vulgaris, or butter-wort; and the lusitanica, or Cornwall butter-wort.

**PINION**, in mechanics, an arbor, or spindle, in the body whereof are several notches, which catch the teeth of a wheel that serves to turn it round: or it is a lesser wheel which plays in the teeth of a larger.

**PINK**, a vessel used at sea, masted and rigged like other ships, only that this is built with a round stern; the bends and ribs compassing so as that her ribs bulge out very much.

**PINK** in botany. See **DIANTHUS**.

**PINNACE**, a small vessel used at sea, with a square stern, having sails and oars, and carrying three masts, chiefly used as a scout for intelligence, and for landing of men, &c.

**PINNACLE**, in architecture, the top or roof of an house, terminating in a point.

**PINNATED LEAVES**, in botany. See **BOTANY**, p. 640.

**PINUS**, in botany, a genus of the monœcia monadelphia class. The calix of the male consists of four leaves; it has no corolla; the stamina are numerous, with naked antheræ. The calix of the female is a strobilus, containing two flowers; it has one pistillum; and the nut is embraced by a membranaceous wing. There are 12 species, three of them natives of Britain, viz. the sylvestris, or Scotch fir; the picea, or yellow-leaved fir; and the abies, or common fir.

**PIONEER**, in the art of war, a labourer employed in an army to smooth the roads, pass the artillery along, and dig lines and trenches, mines, and other works.

**PIPE**, in law, is a roll in the exchequer, called also the great roll. See the next article.

**PIPE-OFFICE**, is an office, wherein a person, called the clerk of the pipe, makes out leases of crown-lands, by warrant from the lord-treasurer, or commissioners of the treasury, or chancellor of the exchequer.

**PIPER**, PEPPER, in botany, a genus of the diandria trigynia class. It has neither calix nor corolla; the berry

contains but one seed. There are 20 species, all natives of warm countries.

**PIPER**, in ichthyology. See **TRIGLA**.

**PIRACY**, in Scots law. See **LAW**, Tit. xxxiii.

**PIRATE**, a person, or vessel, that robs on the high seas, without permission or authority of any prince or state.

**PISA**, a city of Italy, in the duchy of Tuscany, situated on the river Arno, four miles east of the sea, and ten miles north of Leghorn.

**PISCARY**, in our ancient statutes, the liberty of fishing in another man's waters.

**PISCES**, in astronomy, the twelfth sign or constellation of the zodiac. See **ASTRONOMY**, p. 487.

**PISCINA**, in antiquity, a large basin in a public place or square, where the Roman youth learned to swim, and which was surrounded with a high wall, to prevent casting of filth into it.

**PISSAPHALTUM**, **EARTH PITCH**, a fluid, opaque, mineral body, of a thick consistence, of a strong smell, readily inflammable, but leaving a residuum of greyish ashes after burning. It arises out of the cracks of rocks, in several places in the island of Sumatra, and in some other parts of the East-Indies, and is much esteemed there, in paralytic disorders.

**PISSELEUM INDICUM**, **BARBADOES TAR**, a mineral fluid, of the nature of the thicker bitumens, and of all others the most approaching in appearance, colour, and consistence, to the true pissaspaltum, though differing from it in other respects. It is very frequent in many parts of America, where it is found trickling down the sides of mountains in large quantities, and sometimes floating on the surface of the waters. It has been greatly recommended internally in coughs and other disorders of the breast and lungs.

**PISTACIA**, in botany, a genus of the dioecia pentandria class. The calix of the amentum in the male consists of five segments; it has no corolla: The calix of the female consists of three segments; it has no corolla; there are three styli; and the drupa contains one seed. There are five species, all natives of warm climates.

Pistachia-nuts abound with a sweet and well-tasted oil, which they will yield in great abundance, on being pressed after bruising them: they are reckoned wholesome and nutritive, and are very proper to be prescribed by way of restoratives, eaten in a moderate quantity, and to people emaciated with long illnesses.

**PISTIL**, among botanists. See **BOTANY**, p. 637.

**PISTOL**, the smallest piece of fire-arms, born at the saddle bow, on the girdle, and in the pocket.

**PISTOLE**, a gold-coin, struck in Spain, and in several parts of Italy, Switzerland, &c.

The pistole has its augmentations and diminutions, which are quadruple pistoles, double pistoles, and half pistoles.

**PISTON**, in pump-work, is a short cylinder of metal, or other solid substance, fitted exactly to the cavity of the barrel or body of the pump. See **HYDROSTATICS**.

**PISUM**, in botany, a genus of the diadelphia decandria class. The stylus is triangular, carinated and downy above; and the two upper lacinix of the calix are shorter than the rest. The species are four, only one of them, viz. the maritimum, or sea-pease, a native of Britain.

Peas are nutritive, and accordingly used for food; but

rarely for any medicinal purposes, except to keep issues open; for which purpose they are rubbed with basilicon, or linimentum Arcei.

**PITCH**, a tenaceous oily substance, drawn chiefly from pines and firs, and used in shipping, medicine, and various other arts: or it is more properly tar, inspissated by boiling it over a slow fire.

The method of procuring the tar, is by cleaving the trees into small billets, which are laid in a furnace that has two apertures, through one of which the fire is put, and through the other the pitch is gathered, which, oozing from the wood, runs along the bottom of the furnace into places made to receive it. When the smoke, which is here very thick, gives it blackness, this is called tar; which, on being boiled, to consume more of its moisture, becomes pitch.

There is another method of drawing pitch, used in the Levant: a pit is dug in the ground, two ells in diameter at the top, but contracting as it grows deeper; this is filled with branches of pine, cloven into shivers; the wood at the top of the pit is then set on fire, and burning downwards, the tar runs from it out of a hole made in the bottom; and this is boiled, as above, to give it the consistence of pitch.

**PITH**, in vegetation, the soft spongy substance contained in the central parts of plants and trees. See **AGRICULTURE**, Part I.

**PITUITARY GLAND**, in anatomy. See **ANATOMY**, p. 286.

**PLACE**, in war, a general name for all kinds of fortresses where a party may defend themselves.

*Common PLACE.* See **COMMON PLACE**.

**PLACENTA**, in anatomy and midwifery, a soft roundish mass found in the womb of pregnant women; which, from its resemblance to the liver, was called by the ancients hepar uterinum, the uterine liver. See **MIDWIFERY**, p. 208.

**PLACENTIA**, a city of Spain, in the province of Estremadura: W. long. 6°, N. lat. 39° 45'.

**PLAGIARY**, in philology, the purloining another person's works, and putting them off for a man's own. Among the Romans, plagiarus was properly a person who bought, sold, or retained a freeman for a slave; and was so called, because by the Flavian law such persons were condemned, ad plagas, to be whipped.

**PLAGIURI**, among ichthyologists, a class of fishes comprehending all those which have the tails not perpendicular, but placed in an horizontal direction.

**PLAGUE**, **PESTILENCE**, or **PESTILENTIAL FEVER**. See **MEDICINE**, p. 71.

**PLAISE**, the English name of a species of the pleuronectes. See **PLEURONECTES**.

**PLAN**, in general, denotes the representation of something drawn on a plane: such are maps, charts, ichnographies, &c.

The term plan, however, is particularly used for a draught of a building, such as it appears, or is intended to appear, on the ground; shewing the extent, division, and distribution of its area, or ground-plot, into apartments, rooms, passages, &c.

**PLANE**, in geometry, denotes a plain surface, or one that lies evenly between its bounding lines: and as a right line is the shortest extension from one point to another, so a plain

plain surface is the shortest extension from one line to another.

**PLANE**, in joinery, an edged tool, or instrument for parting and shaving of wood smooth.

It consists of a piece of wood, very smooth at bottom, as a stock or shaft; in the middle of which is an aperture, through which a steel edge, or chissel, placed obliquely, passes; which being very sharp, takes off the inequalities of the wood it is slid along.

**PLANE-TREE**, in botany. See **PLATANUS**.

**PLANET**, a celestial body, revolving round the sun as a centre, and continually changing its position, with respect to the fixed stars; whence the name *planet*, which is a Greek word, signifying *wanderer*. See **ASTRONOMY**.

**PLANETARIUM**, the same with orrery. See **ASTRONOMY**, p. 495.

**PLANIMETRY**, that part of geometry which considers lines and plain figures, without considering their height or depth. See **GEOMETRY**.

**PLANISPHERE**, signifies a projection of the sphere, and its various circles on a plane; in which sense maps, wherein are exhibited the meridians, and other circles of the sphere, are planispheres.

**PLANT**, is defined to be an organical body, destitute of sense and spontaneous motion, adhering to another body in such a manner as to draw from it its nourishment, and having power of propagating itself by seeds. See **AGRICULTURE** and **BOTANY**.

*Sensitive PLANT*. See **MIMOSA**.

**PLANTA**, in anatomy, the foot. See **ANATOMY**, p. 185.

**PLANTAGO**, in botany, a genus of the tetrandria monogynia class. The calix and corolla has each four segments; the stamina are very long; and the capsule is bilocular. There are 21 species, eight of them natives of Britain.

The root, leaves, and seeds of plantain, are reckoned cooling and astringent. It is likewise accounted a great healer of fresh wounds.

*Water PLANTAIN*. See **RANUNCULUS**.

**PLANTARIS**, in anatomy. See **ANATOMY**, p. 210.

**PLANTATION**, in the West-Indies, denotes a spot of ground which a planter or person arrived in a new colony, pitches on to cultivate for his own use, or is assigned for that purpose. However, the term plantation is often used in a synonymous sense with colony.

**PLASTER**, in pharmacy, is defined to be an external application, of a harder consistence than our ointments; these are to be spread according to the different circumstances of the wound, place, or patient, either upon linen or leather.

**PLASTER**, among builders, &c. The plaster of Paris is a preparation of several species of gypsums, dug near Mont Maitre, a village in the neighbourhood of Paris; whence the name.

The best sort is hard, white, shining, and marbly; known by the names of plaster-stone, or parget of Mount Maitre. It will neither give fire with steel, nor ferment with aqua fortis; but very freely and readily calcines in the fire, into a very fine plaster; the use of which in building, and casting statues, is well known.

**PLASTIC**, denotes a thing endued with a formative power, or a faculty of forming or fashioning a mass of matter, after the likeness of a living being; such a virtue as some

of the ancient Epicureans, and perhaps the Peripatetics too, imagined to reside in the earth, or at least to have actually resided therein, by means whereof, and without any extraordinary intervention of a creator, it put forth plants, &c. Some of them seem to be of opinion that animals, and even man himself, was the effect of this plastic power.

**PLASTIC ART**, a branch of sculpture, being the art of forming figures of men, birds, beasts, fishes, &c. in plaster, clay, stucco, or the like.

**PLATA**, a small island in the Pacific ocean, near the coast of Peru, situated W. long. 81°, S. lat. 1°. It is also the name of a city of Peru, capital of the province of La Plata, situated in W. long. 66° 30', S. lat. 22° 30'; and also the name of a great river of Peru, which rising in the province of La Plata, and running south-east till it joins the river Paragua, discharges itself into the Atlantic ocean, below the city of Buenos Ayres.

**PLATALEA**, or spoon-bill, in ornithology, a genus belonging to the order of gallæ. The beak is plain, and dilates toward the point into an orbicular form; the feet have three toes, and are half palmated. There are three species, distinguished by their colour.

**PLATANUS**, the **PLANE-TREE**, in botany, a genus of the monocæia polyandria class. The calix both of the male and female is a roundish amentum; the male has no corolla; the corolla of the female consists of many petals; the stigma is bent backward; and the seeds are round. The species are two, none of them natives of Britain.

**PLATBAND**, in gardening, a border or bed of flowers along a wall, or the side of a parterre frequently edged with box, &c.

**PLATBAND** of a door or window is used for the lintel, where that is made square or not much arched.

**PLATFORM**, in the military art, an elevation of earth, on which cannon is placed, to fire on the enemy; such are the mounts in the middle of curtains.

**PLATFORM**, in architecture, is a row of beams, which support the timber-work of a roof, and lie on the top of the wall, where the entablature ought to be raised.

**PLATONIC**, something that relates to Plato, his school-philosophy, opinions, or the like.

**PLATONIC YEAR**, or the **GREAT YEAR**, is a period of time determined by the revolution of the equinoxes. See **ASTRONOMY**, p. 562.

**PLATOON**, in the military art, a small square body of forty or fifty men, drawn out of a battalion of foot, and placed between the squadrons of horse, to sustain them.

**PLATYSMA MYOIDES**, in anatomy. See **ANATOMY**, p. 195.

**PLEA**, in law, is what either party alleges for himself in court, in a cause there depending; and in a more restrained sense, it is the defendant's answer to the plaintiff's declaration.

*Court of Common PLEAS*. See **COMMON-PLEAS**.

**PLEASURE** and pain, says Mr Locke, are simple ideas, which we receive both from sensation and reflection; there being thoughts of the mind, as well as sensations, accompanied with pleasure or pain. See **METAPHYSICS**.

**PLEBEIAN**, any person of the rank of the common people. It is chiefly used in speaking of the ancient Romans, who were divided into senators, knights, and plebeians.

**PLEDGE**,

**PLEDGE**, in Scots law. See **LAW**, Tit. xx. 13.

**PLEDGET**, **BOLSTER**, or **COMPRESS**, in surgery, a kind of flat tent, laid over a wound, to imbibe the superfluous humours, and keep it clean.

**PLEIADES**, in astronomy, an assemblage of stars in the neck of the constellation taurus. See **ASTRONOMY**, p. 487.

**PLENARY**, something complete or full.

**PLENIPOLENTIARY**, a person vested with full power to do any thing. See **EMBASSADOR**.

**PLENITUDE**, the quality of a thing that is full, or that fills another. In medicine, it chiefly denotes a redundancy of blood and humours.

**PLENUM**, in physics, denotes, according to the Cartesians, that state of things, wherein every part of space is supposed to be full of matter; in opposition to a vacuum.

**PLEONASM**, a figure in rhetoric, whereby we use words seemingly superfluous, in order to express a thought with the greater energy: such as, I saw it with my own eyes, &c.

**PLETHORA**, in medicine, a greater redundance of laudable blood and humours than is capable of undergoing those changes which must necessarily happen for the purposes of life without inducing diseases.

**PLEURA**, in anatomy. See **ANATOMY**, p. 278.

**PLEURISY**, in medicine. See **MEDICINE**, p. 89.

**PLEURONECTES**, in ichthyology, a genus belonging to the order of thoracici. Both eyes are on the same side of the head; there are from four to seven rays in the gill-membrane; the body is compressed, the one side resembling the back and the other the belly. There are 17 species.

**PLEXUS**, among anatomists, a bundle of small vessels interwoven in the form of net-work.

**PLIMOUTH**, or **PLYMOUTH**, a port-town of Devonshire, and a station for the building and laying up of ships of war belonging to the royal navy: W, long. 4° 27', N. lat. 50° 26'. It sends two members to parliament.

**PLIMTON**, a borough town of Devonshire, situated near the English Channel, thirty-six miles south-west of Exeter. It sends two members to parliament.

**PLINIA**, in botany, a genus of the polyandria monogynia class. The corolla consists of five petals, and the calix of five segments; the berry is furrowed, and contains one seed. There is but one species, a native of America.

**PLINTH**, in architecture, a flat square member, in the form of a brick.

**PLOCKOW**, the capital of a palatinate of the same name, in Poland fifty miles north-west of Warsaw.

**PLOT**, in dramatic poetry, is sometimes used for the fable of a tragedy or comedy, but more particularly the knot or intrigue, which makes the embarrass of any piece.

**PLOT**, in surveying, the plan or draught of any field, farm, or manor surveyed with an instrument, and laid down in the proper figure and dimensions.

**PLOTTING**, among surveyors, is the art of laying down on paper, &c. the several angles and lines of a tract of ground surveyed by a theodolite, &c. and a chain. See **GEOMETRY**.

**PLOVER**, in ornithology. See **CHARADRIUS**.

**PLOUGH**, in agriculture, a machine for turning up the soil, contrived to save the time, labour, and expence, that without this instrument must have been employed in dig-

ging land, to prepare it for the sowing of all kinds of grain.

See **AGRICULTURE**, p. 54.

**PLOUGHMAN**, the person who guides the plough in the operation of tilling.

**PLOUGHING**, in agriculture, turning up the earth with a plough. See **AGRICULTURE**, p. 57.

**PLUKNETIA**, in botany, a genus of the monœcia monodelphia class. Neither the male nor the female have any calyx; the corolla of each has four petals; the male has four glandular bearded nectaria; the stylus is filiform; the stigma is peltated; and the capsule has four cells, containing one seed. There is but one species, a native of India.

**PLUM-TREE**, in botany. See **PRUNUS**.

**PLUMAGE**, the feathers which serve birds for a covering.

**PLUMB-LINE**, among artificers, denotes a perpendicular to the horizon; so called, as being commonly erected by means of a plummet.

**PLUMBAGO**, in botany, a genus of the pentandria monogynia class. The corolla is bell shaped; the stamina are inserted into scales at the base of the corolla; the stigma is quinquesid; and there is but one oblong truncated seed. The species are four, none of them natives of Britain.

**PLUMBERY**, the art of casting and working lead, and using it in buildings, &c.

As this metal melts very easily, it is easy to cast it into figures of any kind, by running it into moulds of brass, clay, plaster, &c. But the chief article in plumbery is sheets and pipes of lead: and as these make the basis of the plumber's work, we shall here give the process of making them. In casting sheet-lead, a table or mould is made use of, which consists of large pieces of wood well jointed, and bound with bars of iron at the ends, on the sides of which runs a frame consisting of a ledge, or border of wood, two or three inches thick, and two or three inches high from the mould, called the sharps; the ordinary width of the mould, within these sharps, is from three to four feet; and its length is sixteen, seventeen, or eighteen feet. This should be something longer than the sheets are intended to be, in order that the end where the metal runs off from the mould may be cut off, because it is commonly thin or uneven, or ragged at the end. It must stand very even or level in breadth, and something falling from the end in which the metal is poured in, *viz.* about an inch, or an inch and a half, in the length of sixteen or seventeen inches. At the upper end of the mould stands the pan, which is a concave triangular prism, composed of two planks nailed together at right angles, and two triangular pieces fitted in between them at the ends. The length of this pan is the whole breadth of the mould in which the sheets are cast: it stands with its bottom, which is a sharp edge, on a form at the end of the mould, leaning with one side against it; and on the opposite side is a handle to lift it up by, to pour out the melted lead; and on that side of the pan next the mould, are two iron hooks to take hold of the mould, and prevent the pan from slipping, while the melted lead is pouring out of it into the mould. This pan is lined on the inside with moistened sand, to prevent it from being fired by the hot metal. The mould is also spread over, about two thirds of an inch thick, with sand sifted and moist-

ened

ened, which is rendered perfectly level by moving over it a piece of wood called a strike, by tramping upon it with the feet, and smoothing it over with a smoothing plane, which is a thick plate of polished brass, about nine inches square, turned up on all the four edges, and with a handle fitted on to the upper or concave side. The sand being thus smoothed, it is fit for casting sheets of lead: but if they would cast a cistern, they measure out the bigness of the four sides; and having taken the dimensions of the front, or so apart, make mouldings by pressing long slips of wood, which contain the same mouldings, into the level sand, and form the figures of birds, beasts, &c. by pressing in the same manner leaden figures upon it, and then taking them off, and at the same time smoothing the surface where any of the sand is raised up, by making these impressions upon it. The rest of the operation is the same in casting either cisterns or plain sheets of lead: but before we proceed to mention the manner in which that is performed, it will be necessary to give a more particular description of the strike. The strike then is a piece of board about five inches broad, and something longer than the breadth of the mould on the inside; and at each end is cut a notch, about two inches deep, so that when it is used, it rides upon the slips with these notches. Before they begin to cast, the strike is made ready by tacking on two pieces of an old hat on the notches, or by slipping a case of leather over each end, in order to raise the under side about one eighth of an inch, or something more, above the sand, according as they would have the sheet to be in thickness; then they tallow the under edge of the strike, and lay it across the mould. The lead being melted, it is laddled into the pan, in which, when there is a sufficient quantity for the present purpose, the scum of the metal is swept off with a piece of board to the edge of the pan, letting it settle on the sand, which is by this means prevented from falling into the mould at the pouring out of the metal. When the lead is cool enough, which is known by its beginning to stand with a shell or wall on the sand round the pan, two men take the pan by the handle, or else one of them lift it up by a bar and chain fixed to a beam in the ceiling, and pour it into the mould, while another man stands ready with the strike, and, as soon as they have done pouring in the metal, puts on the mould, sweeps the lead forward, and draws the overplus into a trough prepared to receive it. The sheets being thus cast, nothing remains but to planish the edges in order to render them smooth and straight: but if it be a cistern, it is bent into four sides, so that the two ends may join the back, where they are soldered together, after which the bottom is soldered up.

The method of casting thin sheets of lead. Instead of sand, they cover the mould with a piece of woolen stuff nailed down at the two ends to keep it tight, and over this lay a very fine linen cloth. In this process great regard is had to the just degree of heat, so as that the lead may run well, and yet not burn the linen. This they judge of by a piece of paper; for it takes fire in the liquid lead if it is too hot, and if it be not struck and scorched a little, it is not hot enough. They have here a strike different from that described above: it is a wooden case, only closed on three sides: it is pretty high behind; but the two sides, like two acute angles, still diminish to the tip from the place where they are joined to the third or middle piece, where they are of the same height therewith, *viz.* seven or eight

inches high, the width of the middle makes that of the strike, which again makes that of the sheet to the cast. This strike is placed at the top of the mould, which in that part is first covered with a past board that serves as a bottom to the case, and prevents the linen from being burnt while the lead is pouring in. The strike is now filled with lead, according to the quantity to be used; which done, two men, one at each side, draw the strike down the mould with a velocity greater or less, as the sheet is to be more or less thick.

The method of casting pipes without foldering. To make these pipes, they have a kind of little mill, with arms or levers to turn it withal. The moulds are of brass, and consist of two pieces, which open and shut by means of hooks and hinges, their inward caliber, or diameter, being according to the size of the pipe to be made, and their length is usually two feet and a half. In the middle is placed a core, or round piece of brass or iron, somewhat longer than the mould, and of the thickness of the inward diameter of the pipe. This core is passed through two copper-rundles, one at each end of the mould, which they serve to close; and to these is joined a little copper-tube about two inches long, and of the thickness the leaden pipe is intended to be of. By means of these tubes the core is retained in the middle of the cavity of the mould. The core being in the mould, with the rundles at its two ends, and the lead melted in the furnace, they take it up in a ladle and pour it into the mould by a little aperture at one end, made in the form of a funnel. When the mould is full they pass a hook into the end of the core, and turning the mill, draw it out; and then opening the mould, take out the pipe. If they desire to have the pipe lengthened, they put one end of it in the lower end of the mould, and pass the end of the core into it; then shut the mould again, and apply its rundle and tube as before, the pipe just cast serving for rundle, &c. at the other end. Things being thus replaced, they pour in fresh metal, and repeat the operation till they have got a pipe of the length required.

For making pipes of sheet-lead, the plumbers have wooden cylinders of the length and thickness required; and on these they form their pipes by wrapping the sheet around them, and foldering up the edges all along them.

**PLUMBUM, LEAD** See **CHEMISTRY**, p. 84.

**PLUME**, in botany See **AGRICULTURE**, p. 41.

**PLUMMET, PLUMB RULE, or PLUMB LINE**, an instrument used by carpenters, masons, &c. in order to judge whether walls, &c. be upright planes, horizontal, or the like. It is thus called from a piece of lead, fastened to the end of a cord, which usually constitutes this instrument. Sometimes the string descends along a wooden ruler, &c. raised perpendicularly on another; in which case it becomes a level.

**PLUMMING**, among miners, is the method of using a mineral, in order to know the exact place of the work where to sink down an air-shaft, or to bring an adit to the work, or to know which way the load inclines when any flexure happens in it.

It is performed in this manner: A skilful person, with an assistant, and with pen, ink and paper, and a long line, and a quadrant, after his guess of the place above ground, descends into the adit or work, and there fastens one end of the line to some fixed thing in it; then the assisted



The weight or pressure of the air is exactly determined by the following experiment.

*The TORICELLIAN EXPERIMENT.*

Take a glass tube about three feet long, and open at one end: fill it with quicksilver; and putting your finger upon the open end, turn that end downward, and immerse it into a small vessel of quicksilver, without letting in any air: then take away your finger, and the quicksilver will remain suspended in the tube  $29\frac{1}{2}$  inches above its surface in the vessel; sometimes more, and at other times less, as the weight of the air is varied by winds and other causes. That the quicksilver is kept up in the tube by the pressure of the atmosphere upon that in the basin, is evident; for, if the basin and tube be put under a glass, and the air be then taken out of the glass, all the quicksilver in the tube will fall down into the basin; and if the air be let in again, the quicksilver will rise to the same height as before. Therefore the air's pressure on the surface of the earth, is equal to the weight of  $29\frac{1}{2}$  inches depth of quicksilver all over the earth's surface, at a mean rate.

A square column of quicksilver,  $29\frac{1}{2}$  inches high, and one inch thick, weighs just 15 pounds, which is equal to the pressure of air upon every square inch of the earth's surface; and 144 times as much, or 2160 pounds, upon every square foot; because a square foot contains 144 square inches. At this rate, a middle-sized man, whose surface may be about 14 square feet, sustains a pressure of 30240 pounds, when the air is of a mean gravity: a pressure which would be insupportable, and even fatal to us, were it not equal one very part, and counterbalanced by the spring of the air within us, which is diffused through the whole body, and reacts with an equal force against the outward pressure.

Now since the earth's surface contains (in round numbers) 200 000 000 square miles, and every square mile 27,878,400 square feet, there must be 5,575,680 000 000 000 square feet on the earth's surface; which multiplied by 2160 pounds (the pressure on each square foot) gives 12,043,468,800 000 000 000 pounds for the pressure or weight of the whole atmosphere.

When the end of a pipe is immersed in water, and the air is taken out of the pipe, the water will rise in it to the height of 33 feet above the surface of the water in which it is immersed; but will go no higher: for it is found that a common pump will draw water no higher than 33 feet above the surface of the well: and unless the bucket goes within that distance from the well, the water will never get above it. Now, as it is the pressure of the atmosphere, on the surface of the water in the well, that causes the water to ascend in the pump, and follow the piston or bucket, when the air above it is lifted up, it is evident that a column of water 33 feet high, is equal in weight to a column of quicksilver of the same diameter  $29\frac{1}{2}$  inches high; and to as thick a column of air, reaching from the earth's surface to the top of the atmosphere. See HYDROSTATICS.

*OF THE BAROMETER.*

In serene calm weather, the air has weight enough to support a column of quicksilver 31 inches high; but in tempestuous stormy weather, not above 28 inches. The quicksilver, thus supported in a glass tube, is found to be a nice counterbalance to the weight or pressure of the air, and to shew its alterations at different times. And being now ge-

nerally used to denote the changes in the weight of the air, and of the weather consequent upon them, it is called the *barometer*, or weather-glass.

*The mercury will stand at the same height either in an inclined barometer or in an erect one.*

If the mercury at any time stands at the height of 30 inches in the barometer D. (Plate CXLV. fig. 6.) then by inclining this barometer into the position E, the perpendicular height of the mercury will not be altered; for it will still stand at the height of 30 inches: so that if the level AB is 30 inches from the surface FG, the mercury will stand at this level, either in the erect tube D or in the inclined one E. Now here it is evident, that if NL is the height of the mercury when the tube is erect, and NM is the height of the mercury in the same tube or an equal one when it is inclined, there must be more mercury in the inclined tube than there is in the erect one. For we may consider NL as the side, and NM as the diagonal, of a right-angled parallelogram. But the diagonal of a right angled parallelogram is longer than the side. Therefore, though either L or M are at the same perpendicular distance from FG, yet NM will be longer than NL. Since then the column of mercury is longer in the inclined tube than in the erect one, there will be more mercury in the inclined than in the erect one. The question therefore is, How the pressure of the atmosphere can support a greater quantity of matter in one situation of the tube than in the other. We cannot say, that though in the inclined tube there is a greater quantity of mercury than in the erect one, yet a part of this greater weight will be supported by the side of the tube as in an inclined plane. The true answer is, that the column of air which supports the mercury in the inclined tube, is greater than the column which supports it in the erect one. The height of the column of air is indeed the same in both cases; for in either case it is equal to the height of the atmosphere. But the base of the column of air, and consequently its weight, is greater when the tube is inclined than when it is erect. For the base of the column of air which supports the mercury in the tube, is equal to as much of the stagnant mercury's surface as the base of the tube covers. Now, if the diameters of the tubes D and E are equal; the base of the inclined tube E will cover a greater part of the surface FG than the erect tube D covers, or the base of the tube E will be greater than the base of the tube D. For the contents of the inclined tube are greater than those of the erect one, as has been shewn already. But the column of mercury in each of the tubes are cylinders of the same height. Therefore their bases are as their contents. Euc. b. XII. prop. 11. Since then the contents or the weights of mercury in each tube are as their bases, when their heights are equal; and the base of the column of air, which supports the mercury, and consequently the weight of this column, is proportional to the base of the tube; it follows, that the weight of the air will always be proportional to the weight of the mercury when it stands at a given height, whether the tube is inclined or erect.

Though we have here shewn, that the contents of the inclined tube are greater than those of the erect one, and consequently that their bases must be unequal, since their perpendicular heights are the same; yet it will not be improper to shew what we mean by the base of the inclined tube, or rather of the inclined column of mercury, and why this should be greater than the base of the erect one. Now by the

the base of the inclined column we do not mean the bottom of the inclined tube, but the lowest horizontal section of it. Thus, if we consider the surface FG as a plane passing through the two tubes D and E, this plane will cut the tube D perpendicularly, and the tube E obliquely. But a perpendicular section of a cylinder is a circle, and an oblique section of it is an ellipse. Therefore the base of the erect column is circular, and the base of the inclined tube is elliptical. Now, by the supposition, the two tubes have equal diameters, and consequently the shorter axis of the elliptical base will be equal to the diameter of the circular one.

There is another sort of inclined barometer, such as one as ABR, (*ibid.* fig. 7.) which is erect for 28 inches from A to B, and then is inclined from B to C. The mercury will stand at the same height in this barometer, as if it had been a straight one AS: for the column of air pressing at the base A would be the same in either case: and though there is more mercury in the tube ABR than there would be in the tube ABS; yet, supposing the mercury to stand at the same level DC in either case, the pressure of the mercury downwards will in either case be the same. For, the pressure of fluids is as their base and perpendicular height: and here the base A is the same, and the perpendicular height is the same, whether the tube is erect all the way up as AS, or is inclined at the top as ABR.

The advantage which is proposed by these diagonal barometers, as they are called, is to make the variation of the mercury greater, and consequently more apparent, upon a given change in the weather. Thus suppose AB or 23 inches to be the least height of the mercury, and AD or 31 inches to be the greatest height of it: then the whole variation will be within the compass BD, or 3 inches. But if the barometer, instead of being erect at the top, is inclined into the position BC; then, as the mercury stands at the same perpendicular height in this diagonal barometer as in an erect one, AB will be the least height, and ABC will be the greatest height, since D and C are on the same level of at the same perpendicular distance from A. Now though BD, one side of the parallelogram, is but 3 inches long; yet BC may be 30 inches long, or more; and consequently since AB is the least height, and ABC is the greatest height, the variation of the mercury will be much greater than in an erect barometer; in particular, if BC is 30 inches long, the variation will be 30 inches instead of 3, or will be 10 times greater in the diagonal barometer than it would have been in an erect one.

*The barometer stands at the same perpendicular height, whether the tube is large or small.*

If the mercury stands at the same height either in the large tube C or in the small tube D, there must be more mercury in the large one than in the small one. But since the heights are equal, the quantities of mercury contained in these tubes will be as their bases. Now since the columns of air, by which the mercury is supported in these tubes, are as the respective bases of the tubes, the columns of air will be proportional to the weights in each tube, when the perpendicular heights are equal.

But though the heights of the mercury would be the same in small tubes as in large ones, if, as we must suppose in the proposition, the mercury moved equally free in both; yet in fact, upon any change of weather, the variation will be greater in a large tube than in a small one: because, in

a large tube, the weight of mercury is so great, that the motion of it will not be hindered by any attraction or repulsion of the glass upon it; whereas, in a small tube, where the weight of mercury is less, the action of the glass is considerable in proportion to that weight, and consequently the variations will be less upon a given change of the weather.

*The barometer will commonly be low in rainy weather.*

From what has been said already about the barometer, it appears, that the mercury will be low when the weight of the atmosphere is diminished; and such a diminution of the atmosphere will occasion rain. Therefore, since rain is occasioned by the same cause that makes the mercury fall, the barometer will commonly stand low in rainy weather.

*The barometer is the lowest of all in violent storms of wind.*

When the air moves horizontally with a great velocity, as it does in violent storms of wind, its weight, or rather its pressure downwards occasioned by its weight, will be diminished. For as any heavy body may have such a velocity given it, when it is thrown down horizontally, as may either carry it quite off from the earth's centre, or with a velocity as will make it move round the earth in a circle without either departing from the centre or approaching to it; so every degree of velocity given to the air will make it tend or press less towards the centre; and for this reason, as the mercury in the basin will be less pressed, the height of it in the tube will be less in storms than it is any other time.

*When a storm of wind is over, the mercury will rise very fast:*

Because as the horizontal velocity of the air ceases the pressure downwards will be suddenly restored, and consequently the mercury in the barometer will keep rising as this pressure is restored.

#### OF THE THERMOMETER.

*The variations of different thermometers are seldom equal, upon equal variations of heat or cold.*

A THERMOMETER is a well-known instrument for estimating different degrees of heat or cold. It consists of a tube or stem, with a hollow ball at one end of it. The cavity of the ball, and part of the tube, is filled with spirits of wine, or with linseed oil, or with mercury. The upper end of the tube is commonly sealed hermetically. But in sealing this end, the liquor in the thermometer is rarefied by heating it till it almost fills the tube; so that when it is sealed, and the liquor contracts again as it cools, there will be a vacuum left in the upper part of the tube. Any of these fluids will rarefy by heat, and will contract again when they cool: and consequently in warm weather, the spirits, or the oil, or the mercury, whichever the thermometer is made of, will stand higher than in cold weather.

Thus far thermometers may be said to vary alike: they will either rise or sink from the same causes. But then, upon an equal increase of heat, they seldom vary equally, though they are made of the same liquor. One thermometer made with spirits of wine may vary upon an equal increase of heat much more than another that is made with the same sort of spirits: so that if one rises an inch, another may rise but  $\frac{1}{2}$  or  $\frac{2}{3}$  inch.

The variation of a thermometer is directly as the capacity of

of the ball; and inverfely as the bafe of the ftem. Firft, If the bafe of the ftem or cylindrical tube is given, the variation, when the fpirits are equally warmed, will be direftly as the capacity of the ball. For when the fpirits are equally warmed, and confequently are equally rarefied in the balls of two different thermometers, whatever proportion the bulk of the fpirits in one ball bears to the bulk of the fpirits in the other ball before they were rarefied, the fame proportion thefe bulks will ftill bear to each other after they are rarefied. Thus, if one ball is double the other, and confequently the bulk of fpirits in one is double the bulk of fpirits in the other before they are warmed; then, upon being warmed equally, their denfities will diminifh equally. But if their denfities diminifh equally, their bulks will ftill have the fame proportion to each other; or the bulk of fpirits in one thermometer will ftill be double the bulk in the other. But if the bulks continue in the fame proportion to each other, after they are fwelled as they were before; the fpirits muft fwell in proportion to their refpective bulks, or the fpirits in one muft fwell twice as much as in the other. But if the fpirits fwell in this proportion, and by fwelling rife into equal tubes in each, they muft rife twice as high in the tube of one of thefe thermometers as they do in the tube of the other. And fo, in all other inftances, the fpirits, upon being equally warmed, will fwell in proportion to their bulk, that is, in proportion to the capacity of the ball that contains them. But the heights, to which they rife in equal tubes, will be as the increafe of their bulk. Therefore the heights to which they rife, or the variations in equal degrees of heat, will be as the capacity of the ball, when the tubes are equal. We have here fuppofed that the fpirits in the balls of the thermometers are equally heated quite through. In fudden changes of heat and cold, it will be otherwife: for the fpirits in a fmall ball will be fooner heated quite through than in a large one. And confequently, if the heat does not laft long enough to warm the fpirits in a large ball as much as they are warmed in a fmall one, the fpirits will not be equally rarefied in both, and will not fwell in proportion to their refpective bulks; but thofe in the fmall ball will fwell more in proportion than thofe in the large one. Secondly, If the balls are equal, the variations will be inverfely as the bafes of the ftems. For if the balls are equal, then, upon being equally heated, the fpirits contained in them will fwell equally; and confequently equal quantities will rife into the ftems. Now the fpirits which rife into a cylindrical ftem are a cylindrical column. But the heights of equal cylinders are inverfely as their bafes. Therefore, when the balls are equal, and equal cylinders of fpirits rife into the ftems, the heights to which they rife, or the variations, will be inverfely as the bafes of the ftems.

*An univerfal fcale may be made, by which the variations of different thermometers may be compared with one another.*

Let the ball of a thermometer be put into water when it is beginning to freeze, or, which is the fame as to heat or cold, into fnow when it is beginning to melt; and let the place where the fluid in the thermometer ftands be marked. The place where the fluid ftands in fuch a trial is the freezing point. Let the ball of the fame thermometer be put into water juft hot enough to let wax, that fwims upon it, begin to coagulate. This again is another determinate degree of heat, and is to be marked upon the thermometer.

Divide the diftance between thefe two points into 110 equal parts; and each of thefe parts we call a degree. Now a thermometer often finks lower than the freezing point; becaufe the cold is frequently more intefe than what is juft fufficient to make water freeze: for this reafon, the fcale muft not begin from the freezing point. This point, therefore, fhould not be marked 0, nor fhould the point where melted wax begins to coagulate be marked 110. In this fcale, which from the inventor is called Farenheit's fcale, the freezing point is marked 32; and then the point, where melted wax begins to coagulate, being 110 degrees above it, muft be marked 142. When the length of a degree is thus found in one part of the fcale, 32 degrees of the fame length are fet off below the freezing point, and as many fuch degrees as we pleafe are fet off above the point where melted wax begins to coagulate. If the thermometer is made with fpirits of wine, only 33 degrees need be fet off or marked above 142: and then the fcale will begin from 0; 32 degrees will be the freezing point; 142 will be the point where melted wax begins to coagulate; and  $142 + 33 = 175$  degrees will be the higheft point marked in the fcale. The reafon why no higher degree need be marked in a fcale applied to a thermometer made with fpirits, is, that at this degree of heat the fpirits will boil, and confequently the thermometer would burft. But if the thermometer is made with mercury, the fcale fhould contain at leaft 212 degrees from the bottom to the top, or 32 degrees below the freezing point, and 180 above it. The heat of boiling water, at the middle height of the mercury in the barometer, or in the middle weight of the atmofphere, will raife the mercury in the thermometer to 212 degrees, or 180 degrees above the freezing point. A thermometer made with mercury will not burft in fuch a degree of heat as this; for mercury requires a greater degree to make it boil.

In thermometers with fuch a fcale, or, as they are called, in Farenheit's thermometers, the greateft degree of heat in the external parts of the human body is commonly about 96. Boerhave imagined that air, if its heat exceeded 80 or 90 degrees at moft, would be deftructive to the life of animals. But in this he was miftaken. For in the year 1732 the thermometer in Penfylvania was at the height of 96 or 97; and in the year 1734 the height of it at Petersburgh was 98 degrees. The thermometer in our own climate is fcarce ever higher than 78 degrees, and feldom lower than 18; fo that we may reckon 48 degrees to be the middle temperature of our air.

The variations of different thermometers, though they are not equal, may be compared with one another by Farenheit's fcale. For each degree upon different thermometers is proportional to their refpective variations; and confequently, though in equal heats one may vary more than another, yet each will vary an equal number of degrees. Thus, if, upon any given increafe of heat, one thermometer will vary twice as much as another, then the diftance between the freezing point and the point where melted wax begins to coagulate will be twice as great, or 110 degrees will be twice as long, in one as in the other. Therefore each degree will be twice as long in the former thermometer as in the latter. But by the fuppofition, one of thefe thermometers in a given degree of heat will vary twice as much as the other does; and confequently, whatever heat raifes the former one degree, will likewife raife the latter one degree.

*If the ball of a thermometer is dipped into hot water, the fluid in the thermometer will sink a little before it begins to rise.*

Not only fluids, such as spirits, oil, or mercury, but likewise glass, or iron, or almost any hard bodies, will expand when they are heated, and will contract again when they grow cold. Now, when the ball of a thermometer is dipped into hot water, the heat will be communicated to the glass of which the ball is made, before it is communicated to the fluid contained in the ball. By this means the ball will be expanded, and the capacity of it will be increased, so that some of the fluid will sink out of the stem into it. But when the ball has been long enough in the water for the fluid within it to be heated, this fluid will be expanded; and then it will rise into the stem, and will continue to rise as the heat increases.

### OF SOUND.

*Sound, in the body that produces it, is a trembling motion: this motion is communicated to the air, and the air conveys it to the ear.*

WHEN any elastic body is struck, so as to produce a sound, the body, or some part of it, is made to vibrate. This is evident to sense in the strings of a violin or harpsichord; for either the eye may see, or the hand may feel, the trembling of the strings, when by striking them they are made to sound. See MUSIC.

If a bell is struck by its clapper on the inside, the bell is made to vibrate. The base of the bell is a circle; but by striking any part of this circle on the inside, the part which is struck will fly out a little way, so that the diameter, which passes through this part of the circular base, will become longer than another diameter which crosses this at right angles. Therefore by the stroke the base will be changed into an ellipsis, whose longer axis will pass through the part against which the clapper struck. But the elasticity of the bell will restore the figure of the base, and will make the part which was forced out of its place return back. This part in returning will acquire velocity in the same manner as an elastic string would in the same circumstances. And since it acquires velocity in returning to its place, it will not stop at that place, but will over-run it. Thus the circular figure of the base will be changed into an ellipsis again; only now the shorter axis will pass through the part that was first struck. If the bell was to be struck at first by a hammer on the outside, the part struck would move inwards; and such a motion would likewise change the base into an ellipsis: only in this case the shorter axis of the ellipsis would pass through that part where the blow was given. The elasticity of the bell will restore its figure; and as the part which was struck will acquire velocity in returning to its proper situation, the acquired velocity will not suffer it to rest there, but will carry it farther out from the opposite side: and the base will by this means be again changed into an ellipsis, having the longer axis at that part where the blow was first given. Thus we have seen, that where-ever the bell is struck the parts of it will perform one vibration; the part, which is struck will yield to the blow; the elasticity of the bell will bring it back to its former situation; in returning, it will acquire velocity; and as far as the blow had driven it one way, so far the acquired velocity will car-

ry it the other. But since, after one vibration is thus performed, the figure of the base will be elliptical; the parts of the bell will vibrate a second time; and so on, in the same manner that an elastic string vibrates.

The same stroke which makes a bell vibrate makes it sound too; and as the vibrations decay, the sound grows weaker. Our senses may convince us that the parts of a bell are in a trembling or vibratory motion whilst the bell sounds: for if we lay our hand upon it, we may feel it jar; or if small straws or pieces of paper are thrown upon it, we may see that the jarring or trembling of the bell will put them in motion.

But the air must convey this vibratory motion to the ear: for otherwise, though the sounding body is made to vibrate, no sound will be heard. Thus if a bell is rung in the receiver of an air-pump, the sound will grow weaker as the air is exhausted; and when all the air is drawn out of the receiver, no sound at all will be heard. When the air is admitted again into the receiver, the sound will at the first entrance of the air begin to be heard, and will grow louder as more air returns. If the bell was to be rung in like manner in a vessel where the air is condensed, the sound of it would be much louder than it is in common air. And accordingly, when divers are let down to any great depth of water, because the air in the diving-bell is much condensed, they seem to one another to speak much louder than usual.

*The intensity of sound, at different distances from the sounding body, is inversely as the squares of the distances.*

Sounds may differ from one another, both in respect of their tone, and in respect of their intensity or strength. In respect of their tone, they are distinguished into grave and acute; in respect of their intensity, they are distinguished into loud or strong, and low or weak. The tone of any sound depends upon the time that an impression continues, and is not altered by the distance of the ear from the sounding body. But the intensity or strength of any sound depends upon the force with which the particles of air, as they are condensed, strike the ear; and this force is found to be different at different distances, so that a sound which is very loud if we are near the body that produces it, would be weaker if we were farther from it, and our distance from it may be so great that we cannot hear it at all.

The proportion in which the intensity of sound decreases, as the distance of the ear from the sounding body increases, is this: If the different distances at which the ear is placed are to one another as 1, 2, 3, 4, 5; then the squares of those distances are 1, 4, 9, 16, 25; and the intensity of sound will be inversely as these squares, or as the reciprocals of these squares; that is, the strength of the sound will decrease in the same proportion with the fractions,  $\frac{1}{1} \frac{1}{4} \frac{1}{9} \frac{1}{16} \frac{1}{25}$ , which are the reciprocals of 1, 4, 9, 16, 25. This is what we mean when we say that the intensity of sound is inversely as the squares of the distances, or that it decreases in the departure of the ear from the sounding body in the same proportion that the squares of the distances increase.

*The intensity of sound decreases as the vibrations in the sounding body grow weaker.*

If an elastic string was to stop all at once, the sound produced by it would cease immediately. But if the vibrations

of the string decay gradually, the sound will likewise keep growing weaker, till it becomes too weak to be heard. The string performs all its vibrations from the first to the last in equal times, and consequently each pulse that the string produces is produced in an equal time, and upon that account each pulse from the first to the last will have the same thickness. But when the thickness of the pulse is given, the quantity of air, or number of particles, by which the ear is struck, will likewise be given; and the moment with which it is struck, or the intensity of the sound, will be as the velocity with which the particles move. Now the velocity of the string is successively communicated to the particles of air, as they are made to vibrate. Therefore, as the velocity of the string decays, the velocity of the particles, and consequently the intensity of the sound, will likewise decay.

*The intensity of sound is increased by a speaking-trumpet.*

When a man speaks without such a trumpet, the pulses, as they are produced, dilate themselves in all directions, or the motion is immediately communicated to the air all round him. But if he speaks in a trumpet, his voice, that is, the motion produced by his voice, is confined to the small portion of air contained in the trumpet. For this reason, as there are fewer particles to be moved than there are when the motion dilates itself immediately in all directions, the motion that is communicated will be greater, and consequently, when the voice comes out of the trumpet, its intensity or strength will be greater, than it would have been if it had been propagated in all directions at first.

*Sound moves with the same velocity at all distances from the sounding body.*

The sound of a cannon, or of a bell, moves at the rate of 1142 feet in a second at all distances from the gun or the bell. If it moves at this rate for the first mile, it would move just at the same rate for the second mile: so that a person who is within one mile of the cannon when it is discharged, will hear the report just as soon again as another who is at the distance of two miles. The velocity of the sound does not decrease as it is propagated forwards, but continues the same from the first to the last. This property of sound has been proved by repeated experiments.

*When sound strikes against an obstacle, it will be reflected.*

By sound we here mean the pulses in the air, which are, properly speaking, the causes of sound. If these pulses in their progress strike upon any obstacle, such as a rock; a thick wood, or the side of a building, the air, which is condensed at the obstacle, is prevented from expanding itself forwards, or from propagating the sound beyond the obstacle. Therefore, in expanding itself, the motion, which would otherwise have been propagated forwards, will be returned from the obstacle; and a person, who is placed so as to receive the pulses in their return, will hear the sound by reflection. Such a reflected sound is called an echo.

The number of syllables which an echo repeats distinctly depends upon the distance of the obstacle from whence the sound is reflected. The syllables that we hear distinctly repeated are those which are returned after we have done speaking. Therefore, if the obstacle is so near to us, that the first syllable we speak will be returned before we can speak a second, no reflected sound at all can be heard

distinctly; because the direct and reflected sound, or the voice and the echo, will be confounded with one another. If the obstacle is at such a distance, that five syllables may be spoken before one will be returned; then if we speak a sentence consisting of ten syllables, the first five will be reflected whilst we are speaking the five last, so that in speaking the five last syllables the voice will be confounded with the echo of the five first, and we shall hear the echo of only the five last syllables distinctly, because these only will be returned after we have done speaking. But if the obstacle is at such a distance, that we may speak ten syllables before the first of them will return to the speaker; then if we speak a sentence of only ten syllables, we shall have done speaking before the echo begins, and consequently we may hear the whole sentence distinctly repeated by the echo.

Sometimes the same sound is frequently repeated by an echo. This happens when there are several obstacles at different distances. For though there are several obstacles, yet if all of them are at the same distance, the sound will be returned from them all at one and the same time; and consequently the several reflected sounds will be heard together, and will make but one echo. But if the obstacles are at different distances, each will return the sound at a different time, and as many echoes will be heard as there are obstacles that produce them.

#### The DIVING BELL.

THE air in a diving-bell is compressed by the weight of the atmosphere before the bell is let down into the water. But when it has sunk 35 feet below the surface, the air contained in it is compressed by the weight of the atmosphere as before, and by the weight of 35 feet of water besides, which is equiv. lent to another atmosphere. Therefore the compressing force at this depth is doubled, and consequently the air in the bell will then be twice as dense as the common air that we breathe. As much air, likewise, as just fills the bell, when it is at the surface of the water, will, at the depth of 35 feet, only fill half of it; for as the compressing force is doubled, the same quantity of air will be reduced to half its usual dimensions. For this reason, the water would rise into the bell, through the base or bottom of it, which is always open, and would fill the other half of it, if there was not a contrivance for bringing down additional air enough to force out this water, and to keep the whole capacity of the bell full of air. However, the air which fills it will, at the depth of 35 feet, have twice the density that common air has; and at the depth of 70 feet; where it will be compressed by the weight of another atmosphere, it will have triple the density of common air.

We shall here give a short account of the contrivance for bringing down additional air to the diving-bell: because it will serve to shew, that if a vessel full of air is sunk into water, then the water communicates with the air in the vessel, and the pressure upon that air will be so much the greater as the vessel is sunk farther below the surface of the water. The contrivance is this. A barrel is made use of, which has one bung-hole in the lower part of it, and another in the upper part. A leathern pipe is fastened to the hole in the upper part; and this pipe is so long, that, when it hangs down on the outside of the barrel, its orifice reaches below the bung-hole in the lower part. If this barrel, by the help of weights fastened to it, is made to sink with its bottom downwards, the water, by pressing against the lower bung-

bung hole, will condense the air contained in the barrel: for, notwithstanding this pressure, none of the air can escape through the upper hole, because it is kept in by a greater pressure against the orifice of the leathern pipe which hangs below the bottom of the barrel, and consequently, being deeper in the water, sustains a greater pressure than what acts against the lower bung-hole. If the barrel is let down in this manner, till it gets below the bell, and then the end of the leathern pipe is lifted up into the bell; the lower bung-hole will then be more pressed than the orifice of the pipe; and therefore the air contained in the barrel will be driven up through the pipe, and will be received into the bell. And because the barrel is deeper in the water than the bell is, the water will press more against the base of the barrel to force the air out of it than it does against the base of the bell: for which reason the air will rush out of the barrel with force enough to drive out any water which had risen into the bell whilst it was descending.

By the same contrivance, fresh air is brought down to the bell as often as there is occasion for it. The air, which has been heated by frequently breathing it, is let out through a stop cock in the top of the bell and rises in bubbles to the surface of the water, whilst fresh air is received from the leathern pipe of a barrel contrived in the manner already described.

#### AIR necessary for the LIFE of ANIMALS.

ALL common air is impregnated with a certain kind of *vivifying spirit* or quality, which is necessary to continue the lives of animals: and this, in a gallon of air, is sufficient for one man during the space of a minute, and not much longer.

This spirit in air is destroyed by passing through the lungs of animals; and hence it is, that an animal dies soon, after being put under a vessel which admits no fresh air to come to it. This spirit is also in the air which is in water; for fish die when they are excluded from fresh air, as in a pond that is closely frozen over. And the little eggs of insects stopped up in a glass, do not produce their young, though assisted by a kindly warmth. The seeds also of plants mixed with good earth, and inclosed in a glass, will not grow.

This enlivening quality in air is also destroyed by the air's passing through fire; particularly charcoal fire, or the flame of sulphur. Hence smoking chimneys must be very unwholesome, especially if the rooms they are in be small and close. See *SMOKE*.

Air is also vitiated, by remaining closely pent up in any place for a considerable time; or perhaps, by being mixed with malignant steams and particles flowing from the neighbouring bodies; or lastly, by the corruption of the vivifying spirit; as in the holds of ships, in oil-cisterns or wine-cellars, which have been shut up for a considerable time. The air in any of them is sometimes so much vitiated, as to be immediate death to any animal that comes into it.

Air that has lost its vivifying spirit is called *damp*, not only because it is filled with humid or moist vapours, but because it deadens fire, extinguishes flame, and destroys life. The dreadful effects of damps are sufficiently known to such as work in mines.

The atmosphere is the common receptacle of all the effluvia or vapours arising from different bodies; of the steams and smoke of things burnt or melted; the fogs or vapours proceeding from damp watery places; and of effluvia from

sulphureous, nitrous, acid, and alkaline bodies. In short, whatever may be called volatile, rises in the air to greater or less heights, according to its specific gravity.

When the effluvia which arise from acid and alkaline bodies meet each other in the air, there will be a strong conflict or *fermentation* between them; which will sometimes be so great, as to produce a fire, then if the effluvia be combustible, the fire will run from one part to another, just as the inflammable matter happens to lie.

Any one may be convinced of this, by mixing an acid and an alkaline fluid together, as the spirit of nitre and oil of cloves; upon the doing of which, a sudden ferment, with a fine flame, will arise; and if the ingredients be very pure and strong, there will be a sudden explosion.

Whoever considers the effects of fermentation, cannot be at a loss to account for the dreadful effects of *thunder* and *lightening*; (see *ELECTRICITY*;) For the effluvia of sulphureous and nitrous bodies, and others that may rise into the atmosphere, will ferment with each other, and take fire very often of themselves; sometimes by the assistance of the sun's heat.

If the inflammable matter be thin and light, it will rise to the upper part of the atmosphere, where it will flash without doing any harm; but if it be dense, it will lie nearer the surface of the earth, where taking fire, it will explode with a surprising force; and by its heat rarefy and drive away the air, kill men and cattle, split trees, walls, rocks, &c. and be accompanied with terrible claps of thunder.

The heat of lightening appears to be quite different from that of other fires; for it has been known to run through wood, leather, cloth, &c. without hurting them, while it has broken and melted iron, steel, silver, gold, and other hard bodies. Thus it has melted or burnt asunder a sword, without hurting the scabbard; and money in a man's pocket, without hurting his cloaths: the reason of this seems to be, that the particles of the fire are so fine, as to pass through soft loose bodies without dissolving them; whilst they spend their whole force upon the hard ones.

It is remarkable, that knives and forks which have been struck with lightening have a very strong magnetical virtue for several years after.

Much of the same kind with lightening, are those explosions, called *fulminating* or *fire-damps*, which sometimes happen in mines; and are occasioned by sulphureous and nitrous, or rather oleaginous particles, rising from the mine, and mixing with the air, where they will take fire by the lights which the workmen are obliged to make use of. The fire being kindled will run from one part of the mine to another, like a train of gunpowder, as the combustible matter happens to lie. And as the elasticity of the air is increased by heat, that in the mine will consequently swell very much, and so, for want of room, will explode with a greater or less degree of force, according to the density of the combustible vapours. It is sometimes so strong as to blow up the mine; and at other times so weak, that when it has taken fire at the flame of a candle, it is easily blown out.

Air that will take fire at the flame of a candle may be produced thus. Having exhausted a receiver of the air-pump; let the air run into it through the flame of the oil of turpentine: then remove the cover of the receiver; and holding a candle to that air, it will take fire, and burn quicker or slower, according to the density of the oleaginous vapour.

When such combustible matter, as is above-mentioned, kindles

kindles in the bowels of the earth, where there is little or no vent, it produces *earthquakes*, and violent storms or hurricanes of wind when it breaks forth into the air.

An artificial earthquake may be made thus. Take 10 or 15 pounds of sulphur, and as much of the filings of iron, and knead them with common water into the consistence of a paste: this being buried in the ground, will, in 8 or 10 hours time, burst out in flames, and cause the earth to tremble all around to a considerable distance.

From this experiment we have a very natural account of the fire of mount *Ætna*, *Veluvius*, and other volcano's, they being probably set on fire at first by the mixture of such metalline and sulphureous particles.

#### Of the AIR-PUMP.

THE *air-pump* being in effect the same as the water-pump, (see *HYDROSTATICS*.) whoever understands the one will be at no loss to understand the other.

Having put a wet leather on the plate *LL* of the air-pump, (Plate *CXLV*. fig. 8.) place the glass receiver *M* upon the leather, so that the hole *i* in the plate may be within the glass. Then, turning the handle *F* backward and forward, the air will be pumped out of the receiver; which will then be held down to the plate by the pressure of the external air or atmosphere. For, as the handle (fig. 9.) is turned backwards, it raises the piston *de* in the barrel *BK*, by means of the wheel *F* and rack *Dd*; and as the piston is leathered so tight, as to fit the barrel exactly, no air can get between the piston and barrel; and therefore, all the air above *d* in the barrel is lifted up towards *B*, and a vacuum is made in the barrel from *e* to *b*; upon which, part of the air in the receiver *M* (fig. 8.) by its spring, rushes through the hole *i*, in the brass plate *LL*, along the pipe *CCG* (which communicates with both barrels by the hollow trunk *IHK* (fig. 9) and, pushing up the valve *b*, enters into the vacant place *be* of the barrel *BK*. For, where-ever the resistance or pressure is taken off, the air will run to that place, if it can find a passage.—Then, as the handle *F* will be turned forward, the piston *de* will be depressed in the barrel: and, as the air which had got into the barrel cannot be pushed back through the valve *b*, it will ascend through a hole in the piston, and escape through a valve at *d*; and be hindered by that valve from returning into the barrel, when the piston is again raised. At the next raising of the piston, a vacuum is again made in the same manner as before, between *b* and *e*; upon which more of the air, which was left in the receiver *M*, gets out thence by its spring, and runs into the barrel *BK*, through the valve *B*. The same thing is to be understood with regard to the other barrel *Al*, and as the handle *F* is turned backwards and forwards, it alternately raises and depresses the pistons in their barrels, always raising one whilst it depresses the other. And, as there is a vacuum made in each barrel when its piston is raised, every particle of air in the receiver *M* pushes out another, by its spring or elasticity, through the hole *i* and pipe *CC*, into the barrels, until at last the air in the receiver comes to be so much dilated, and its spring so far weakened, that it can no longer get through the valves: and then no more can be taken out. Hence there is no such thing as making a perfect vacuum in the receiver: for the quantity of air taken out at any one stroke, will always be as the density thereof in the receiver: and therefore it is impossible to take it all out, be-

cause, supposing the receiver and barrels of equal capacity, there will be always as much left as was taken out at the last turn of the handle.

There is a cock *k* below the pump-plate, which being turned lets the air into the receiver again; and then the receiver becomes loose, and may be taken off the plate. The barrels are fixed to the frame *Eee* by two screw-nuts *ff*, which press down the top piece *E* upon the barrels; and the hollow trunk *H* (in fig. 9.) is covered by a box, as *GH* in fig. 8.

There is a glass tube *lmnn* open at both ends, and about 34 inches long; the upper end communicating with the hole in the pump-plate; and the lower end immersed in quicksilver at *n* in the vessel *N*. To this tube is fitted a wooden ruler *mm*, called the *gag*, which is divided into inches and parts of an inch, from the bottom at *n* (where it is even with the surface of the quicksilver) and continued up to the top, a little below *l*, to 30 or 31 inches.

As the air is pumped out of the receiver *M*, it is likewise pumped out of the glass tube *lmn*, because that tube opens into the receiver through the pump-plate; and as the tube is gradually emptied of air, the quicksilver in the vessel *N* is forced up into the tube by the pressure of the atmosphere: And if the receiver could be perfectly exhausted of air, the quicksilver would stand as high in the tube as it does at that time in the barometer: for it is supported by the same power or weight of the atmosphere in both.

The quantity of air exhausted out of the receiver on each turn of the handle, is always proportionable to the ascent of the quicksilver on that turn; and the quantity of air remaining in the receiver, is proportionable to the descent of the height of the quicksilver in the gag, from what it is at that time in the barometer.

#### EXPERIMENTS WITH THE AIR-PUMP.

##### I. To shew the resistance of the air.

1. THERE is a little machine, consisting of two mills, *a* and *b*, (*ibid*. fig. 10.) which are of equal weights, independent of each other, and turn equally free on their axes in the frame. Each mill has four thin arms or sails fixed into the axis; those of the mill *a* have their planes at right angles to its axis, and those of *b* have their planes parallel to it. Therefore, as the mill *a* turns round in common air, it is but little resisted thereby, because its sails cut the air with their thin edges: but the mill *b* is much resisted, because the broad sides of its sails move against the air when it turns round. In each axle is a pin near the middle of the frame, which goes quite through the axle, and stands out a little on each side of it; upon these pins, the slider *d* may be made to bear, and so hinder the mills from going when the strong spring *c* is set on bend against the opposite ends of the pins.

Having set this machine upon the pump-plate *LL* (fig. 8.) draw up the slider *d* to the pins on one side, and set the spring *c* at bend upon the opposite ends of the pins; then push down the slider *d*, and the spring acting equally strong on each mill, will set them both going with equal forces and velocities: but the mill *a* will run much longer than the mill *b*, because the air makes much less resistance against the edges of its sails than against the sides of the sails of *b*.

Draw up the slider again, and set the spring upon the pins as before; then cover the machine with the receiver *M* (fig. 8.) upon the pump-plate, and having exhausted the receiver of air, push down the wire *PP* (through the collar of leathers in the neck *q*) upon the slider; which will disengage it from the pins, and allow the mills to turn round by the impulse of the spring; and as there is no air in the receiver to make any sensible resistance against them, they will both move a considerable time longer than they did in the open air; and the moment that one stops, the other will do so too.—This shews that air resists bodies in motion, and that equal bodies meet with different degrees of resistance, according as they present greater or less surfaces to the air, in the planes of their motions.

2. Take off the receiver *M* (fig. 11.) and the mills; and having put the guinea *a* and feather *b* upon the brass flap *c*, turn up the flap, and shut it into the notch *d*. Then, putting a wet leather over the top of the tall receiver *AB* (it being open both at top and bottom) cover it with the plate *C*, from which the guinea and feather tongs *ed* will then hang within the receiver. This done, pump the air out of the receiver; and then draw up the wire *f* a little, which by a square piece on its lower end will open the tongs *ed*; and the flap falling down, as at *e*, the guinea and feather will descend with equal velocities in the receiver; and both will fall upon the pump-plate at the same instant. *N.B.* In this experiment, the observers ought not to look at the top, but at the bottom of the receiver; in order to see the guinea and feather fall upon the plate; otherwise, on account of the quickness of their motion, they will escape the sight of the beholders.

## II. To shew the weight of the air.

1. Having fitted a brass cap, with a valve tied over it, to the mouth of a thin bottle or Florence flask, whose contents are exactly known, screw the neck of this cap into the hole *i* of the pump-plate; then, having exhausted the air out of the flask, and taken it off from the pump, let it be suspended at one end of a balance, and nicely counterpoised by weights in the scale at the other end; this done, raise up the valve with a pin, and the air will rush into the flask with an audible noise; during which time, the flask will descend, and pull down that end of the beam. When the noise is over, put as many grains into the scale at the other end as will restore the equilibrium; and they will shew exactly the weight of the quantity of air which has got into the flask, and filled it. If the flask holds an exact quart, it will be found, that 17 grains will restore the equipoise of the balance, when the quicksilver stands at  $29\frac{1}{2}$  inches in the barometer, which shews, that when the air is at a mean rate of density, a quart of it weighs 17 grains; it weighs more when the quicksilver stands higher, and less when it stands lower.

2. Place the small receiver *O* (fig. 8.) over the hole *i* in the pump-plate; and upon exhausting the air, the receiver will be fixed down to the plate by the pressure of the air on its outside, which is left to act alone, without any air in the receiver to act against it; and this pressure will be equal to as many times 15 pounds, as there are square inches in that part of the plate which the receiver covers; which will hold down the receiver so fast, that it cannot be got off, until the air be let into it by turning the cock *k*; and then it becomes loose.

3. Set the little glass *AB* (fig. 12.) (which is open at both ends) over the hole *i* upon the pump-plate *LL*, and put your hand close upon the top of it at *B*; then upon exhausting the air out of the glass, you will find your hand pressed down with a great weight upon it; so that you can hardly release it, until the air be readmitted into the glass by turning the cock *k*; which air, by acting as strongly upward against the hand as the external air acted in pressing it downward, will release the hand from its confinement.

4. Having tied a piece of wet bladder *b* (fig. 13.) over the open top of the glass *A* (which is also open at bottom) set it to dry, and then the bladder will be tight like a drum. Then place the open end *A* upon the pump-plate, over the hole *i*, and begin to exhaust the air out of the glass. As the air is exhausting, its spring in the glass will be weakened, and give way to the pressure of the outward air on the bladder, which, as it is pressed down, will put on a spherical concave figure, which will grow deeper and deeper, until the strength of the bladder be overcome by the weight of the air; and then it will break with a report as loud as that of a gun.—If a flat piece of glass be laid upon the open top of this receiver, and joined to it by a flat ring of wet leather between them; upon pumping the air out of the receiver, the pressure of the outward air upon the flat glass will break it all to pieces.

5. Immerse the neck *cd* (fig. 14.) of the hollow glass ball *eb* in water, contained in the phial *aa*; then set it upon the pump-plate, and cover it and the hole *i* with the close receiver *A*; and then begin to pump out the air. As the air goes out of the receiver by its spring, it will also by the same means go out of the hollow ball *eb*, through the neck *dc*, and rise up in bubbles to the surface of the water in the phial; from whence it will make its way, with the rest of the air in the receiver, through the air-pipe *GG* and valves *a* and *b*, into the open air. When it has done bubbling in the phial, the ball is sufficiently exhausted; and then, upon turning the cock *k*, the air will get into the receiver, and press so upon the surface of the water in the phial, as to force the water up into the ball in a jet, through the neck *cd*, and will fill the ball almost full of water. The reason why the ball is not quite filled, is because all the air could not be taken out of it; and the small quantity that was left in, and had expanded itself so as to fill the whole ball, is now condensed into the same state as the outward air, and remains in a small bubble at the top of the ball; and so keeps the water from filling that part of the ball.

6. Pour some quicksilver into the jar *D* (fig. 15.) and set it on the pump plate near the hole *i*; then set on the tall open receiver *AB*, so as to be over the jar and hole; and cover the receiver with the brass plate *C*. Screw the open glass tube *fg* (which has a brass top on it at *b*) into the syringe *H*; and putting the tube through a hole in the middle of the plate, so as to immerse the lower end of the tube *e* in the quicksilver at *D*, screw the end *b* of the syringe into the plate. This done, draw up the piston in the syringe by the ring *I*, which will make a vacuum in the syringe below the piston; and as the upper end of the tube opens into the syringe, the air will be dilated in the tube, because part of it, by its spring, gets up into the syringe; and the spring of the undilated air in the receiver acting upon the surface of the quicksilver in the jar, will force part of it up into the tube: for the quicksilver will follow the piston in the syringe, in the same way, and for the same reason, that wa-

ter follows the piston of a common pump when it is raised in the pump-barrel; and this, according to some, is done by suction. But to refute that erroneous notion, let the air be pumped out of the receiver *AB*, and then all the quicksilver in the tube will fall down by its own weight into the jar; and cannot be again raised one hair's breadth in the tube by working the syringe: which shews, that suction had no hand in raising the quicksilver: and, to prove that it is done by pressure, let the air into the receiver by the cock *k* (fig. 8.) and its action upon the surface of the quicksilver in the jar will raise it up into the tube, although the piston of the syringe continues motionless. If the tube be about 32 or 33 inches high, the quicksilver will rise in it very near as high as it stands at that time in the barometer. And, if the syringe has a small hole, as *m*, near the top of it, and the piston be drawn up above that hole, the air will rush through the hole into the syringe and tube, and the quicksilver will immediately fall down into the jar. If this part of the apparatus be air tight, the quicksilver may be pumped up into the tube to the same height that it stands in the barometer; but it will go no higher, because then the weight of the column in the tube is the same as the weight of a column of air of the same thickness with the quicksilver, and reaching from the earth to the top of the atmosphere.

7. Having placed the jar *A* (fig. 16.) with some quicksilver in it, on the pump-plate, as in the last experiment, cover it with the receiver *B* then push the open end of the glass-tube *de* through the collar of leathers in the brass neck *C* (which it fits so as to be air-tight) almost down to the quicksilver in the jar. Then exhaust the air out of the receiver, and it will also come out of the tube, because the tube is close at top. When the gauge *mm* shews that the receiver is well exhausted, push down the tube, so as to immerse its lower end into the quicksilver in the jar. Now, although the tube be exhausted of air, none of the quicksilver will rise into it, because there is no air left in the receiver to press upon its surface in the jar. But let the air into the receiver by the cock *k*, and the quicksilver will immediately rise in the tube; and stand as high in it, as it was pumped up in the last experiment.

Both these experiments shew, that the quicksilver is supported in the barometer by the pressure of the air on its surface in the box, in which the open end of the tube is placed: and that the more dense and heavy the air is, the higher does the quicksilver rise; and, on the contrary, the thinner and lighter the air is, the more will the quicksilver fall. For, if the handle *F* be turned ever so little, it takes some air out of the receiver, by raising one or other of the pistons in its barrel: and consequently, that which remains in the receiver is so much the rarer, and has so much the less spring and weight; and thereupon, the quicksilver falls a little in the tube; but upon turning the cock, and re-admitting the air into the receiver, it becomes as weighty as before, and the quicksilver rises again to the same height.—Thus we see the reason why the quicksilver in the barometer falls before rain or snow, and rises before fair weather; for, in the former case, the air is too thin and light to bear up the vapours, and in the latter too dense and heavy to let them fall.

*N. B.* In all mercurial experiments with the air-pump, a short pipe must be screwed into the hole *i*, so as to rise about an inch above the plate, to prevent the quicksilver

from getting into the air-pipe and barrels, in case any of it should be accidentally spilt over the jar; for if it once gets into the pipes or barrels, it spoils them, by loosening the solder, and corroding the brass.

8. Take the tube out of the receiver, and put one end of a bit of dry hazel-branch, about an inch long, tight into the hole, and the other end tight into a hole quite through the bottom of a small wooden cup: then pour some quicksilver into the cup, and exhaust the receiver of air; and the pressure of the outward air, on the surface of the quicksilver, will force it through the pores of the hazel, from whence it will descend in a beautiful shower into a cup placed under the receiver to catch it.

9. Put a wire through the collar of leathers in the top of the receiver, and fix a bit of dry wood on the end of the wire within the receiver; then exhaust the air, and push the wire down, so as to immerse the wood into a jar of quicksilver on the pump-plate: this done, let in the air; and upon taking the wood out of the jar, and splitting it, its pores will be found full of quicksilver, which the force of the air, upon being let into the receiver, drove into the wood.

10. Join the two brass hemispherical cups *A* and *B* (fig. 17.) together, with a wet leather between them, having a hole in the middle of it; then screw the end *D* of the pipe *CD* into the plate of the pump at *i*, and turn the cock *E*, so as the pipe may be open all the way into the cavity of the hemispheres; then exhaust the air out of them, and turn the cock a quarter round, which will shut the pipe *CD*, and keep out the air. This done, unscrew the pipe at *D* from the pump, and screw the piece *Fb* upon it at *D*; and let two strong men try to pull the hemispheres asunder by the rings *g* and *h*, which they will find hard to do; for if the diameter of the hemispheres be four inches, they will be pressed together by the external air with a force equal to 188 pounds. And to shew that it is the pressure of the air that keeps them together, hang them by either of the rings upon the hook *P* of the wire in the receiver *M* (fig. 8.) and upon exhausting the air out of the receiver, they will fall asunder of themselves.

11. Place a small receiver *O* (fig. 8.) near the hole *i* on the pump-plate, and cover both it and the hole with the receiver *M*; and turn the wire so by the top *P*, that its hook may take hold of the little receiver by a ring at its top, allowing that receiver to stand with its own weight on the plate. Then, upon working the pump, the air will come out of both receivers: but the large one *M* will be forcibly held down to the pump by the pressure of the external air; whilst the small one *O*, having no air to press upon it, will continue loose, and may be drawn up and let down at pleasure, by the wire *PP*. But, upon letting it quite down to the plate, and admitting the air into the receiver *M*, by the cock *k*, the air will press so strongly upon the small receiver *O*, as to fix it down to the plate; and at the same time, by counterbalancing the outward pressure on the large receiver *M*, it will become loose. This experiment evidently shews, that the receivers are held down by pressure, and not by suction, for the internal receiver continued loose whilst the operator was pumping, and the external one was held down: but the former became fast immediately, by letting in the air upon it.

12. Screw the end *A* (fig. 18.) of the brass pipe *ABF* into the hole of the pump-plate, and turn the cock *e* until the pipe be open; then put a wet leather upon the plate *cd*, which

which is fixed on the pipe, and cover it with the tall receiver *GH*, which is close at top; then exhault the air out of the receiver, and turn the cock *e* to keep it out; which done, unscrew the pipe from the pump, and set its end *A* into a bason of water, and turn the cock *e* to open the pipe; on which, as there is no air in the receiver, the pressure of the atmosphere on the water in the bason will drive the water forcibly through the pipe, and make it play up in a jet to the top of the receiver.

13. Set the square phial *A* (fig. 21.) upon the pump-plate; and having covered it with the wire-cage *B*, put a close receiver over it, and exhault the air out of the receiver; in doing of which, the air will also make its way out of the phial through a small hole in its neck under the valve *b*. When the air is exhaulted, turn the cock below the plate, to re-admit the air into the receiver; and as it cannot get into the phial again, because of the valve, the phial will be broke into some thousands of pieces by the pressure of the air upon it. Had the phial been of a round form, it would have sustained this pressure like an arch, without breaking; but as its sides are flat, it cannot.

*To shew the elasticity or spring of the air.*

14. Tie up a very small quantity of air in a bladder, and put it under a receiver; then exhault the air out of the receiver, and the small quantity which is confined in the bladder (having nothing to act against it) will expand itself so by the force of its spring, as to fill the bladder as full as it could be blown of common air. But upon letting the air into the receiver again, it will overpower the air in the bladder, and press its sides almost close together.

15. If the bladder so tied up be put into a wooden box, and have 20 or 30 pounds weight of lead put upon it in the box, and the box be covered with a close receiver; upon exhaulting the air out of the receiver, that air which is confined in the bladder will expand itself so, as to raise up all the lead by the force of its spring.

16. Take the glass-ball mentioned in the fifth experiment, (fig. 14.) which was left full of water all but a small bubble of air at top; and having set it with its neck downward into the empty phial *aa*, and covered it with a close receiver, exhault the air out of the receiver, and the small bubble of air in the top of the ball will expand itself, so as to force all the water out of the ball into the phial.

17. Screw the pipe *AB* (fig. 18.) into the pump-plate, place the tall receiver *GH* upon the plate *cd*, as in the twelfth experiment, and exhault the air out of the receiver: then, turn the cock *e*, to keep out the air; unscrew the pipe from the pump, and screw it into the mouth of the copper vessel *CC* (fig. 22.) the vessel having first been about half filled with water. Then turn the cock *e* (fig. 18.) and the spring of the air which is confined in the upper vessel will force the water up through the pipe *AB* in a jet into the exhaulted receiver, as strongly as it did, by its pressure on the surface of the water in a bason, in the twelfth experiment.

18. If a fowl, a cat, rat, a mouse, or bird, be put under a receiver, and the air be exhaulted, the animal will be at first oppressed as with a great weight, then grow convulsed, and at last expire in all the agonies of a most bitter and cruel death.

19. If a butterfly be suspended in a receiver, by a fine thread tied to one of its horns, it will fly about in the receiver, as long as the receiver continues full of air; but if

the air be exhaulted, though the animal will not die, and will continue to flutter its wings, it cannot remove itself from the place where it hangs in the middle of the receiver, until the air be let in again, and then the animal will fly about as before.

20. Pour some quicksilver into the small bottle *A* (fig. 19.) and screw the brass collar *c* of the tube *BC* into the brass neck *b* of the bottle, and the lower end of the tube will be immersed into the quicksilver, so that the air above the quicksilver in the bottle will be confined there, because it cannot get out about the joinings, nor can it be drawn out through the quicksilver into the tube. This tube is also open at top, and is to be covered with the receiver *G* and large tube *EF*, which tube is fixed by brass collars to the receiver, and is close at the top. This preparation being made, exhault the air both out of the receiver and its tube; and the air will by the same means be exhaulted out of the inner tube *BC*, through its open top at *C*; and as the receiver and tubes are exhaulting, the air that is confined in the glass bottle *A* will press so by its spring upon the surface of the quicksilver, as to force it up in the inner tube as high as it was raised in the ninth experiment by the pressure of the atmosphere; which demonstrates that the spring of the air is equivalent to its weight.

21. Screw the end *C* (fig. 20.) of the pipe *GD* into the hole of the pump-plate, and turn all the three cocks *d*, *G*, and *H*, so as to open the communications between all the three pipes *E*, *F*, *DC*, and the hollow trunk *AB*. Then, cover the plates *g* and *h* with wet leathers, which have holes in their middle where the pipes open into the plates; and place the close receiver *I* upon the plate *g*: this done, shut the pipe *F* by turning the cock *H*, and exhault the air out of the receiver *I*. Then turn the cock *d*, to shut out the air; unscrew the machine from the pump; and having screwed it to the wooden foot *L*, put the receiver *K* upon the plate *b*: this receiver will continue loose on the plate as long as it keeps full of air; which it will do until the cock *H* be turned to open the communication between the pipes *F* and *E*, through the trunk *AB*; and then the air in the receiver *K*, having nothing to act against its spring, will run from *K* into *I*, until it be so divided between these receivers, as to be of equal density in both; and they will be held down with equal forces to their plates by the pressure of the atmosphere, though each receiver will then be kept down but with one half of pressure upon it that the receiver *I* had when it was exhaulted of air; because it has now one half of the common air in it which filled the receiver *K* when it was set upon the plate; and therefore a force equal to half the force of the spring of common air will act within the receivers against the whole pressure of the common air upon their outides. This is called transferring the air out of one vessel into another.

22. Put a cork into the square phial *A*, (fig. 21.) and fix it in with wax or cement; put the phial upon the pump plate with the wire-cage *B* over it, and cover the cage with a close receiver. Then, exhault the air out of the receiver; and the air that was corked up in the phial will break the phial outwards by the force of its spring, because there is no air left on the outside of the phial to act against the air within it.

23. Put a shrivelled apple under a close receiver, and exhault the air; then the spring of the air within the apple will plump it out, so as to cause all the wrinkles disappear;

Fig 1. PHEONS



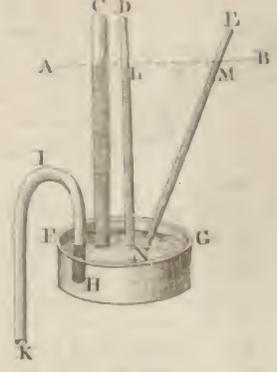
Fig 2. POINTS



Fig 3. PORTA L.



Fig 6



POMME



Fig 4. POTANCE



Fig 5. POTENT



POINTEE

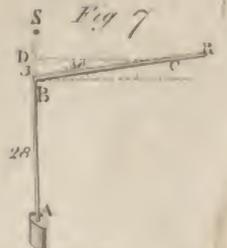


Fig 8.



Fig 9.

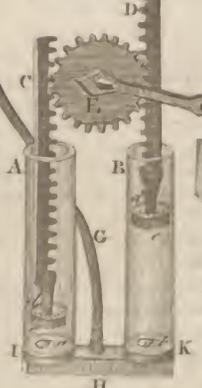


Fig 20

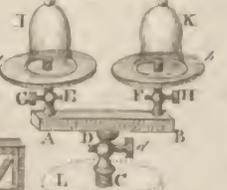


Fig 15



Fig 10.



Fig 22



Fig 21



Fig 13



Fig 12



Fig 15



Fig 18

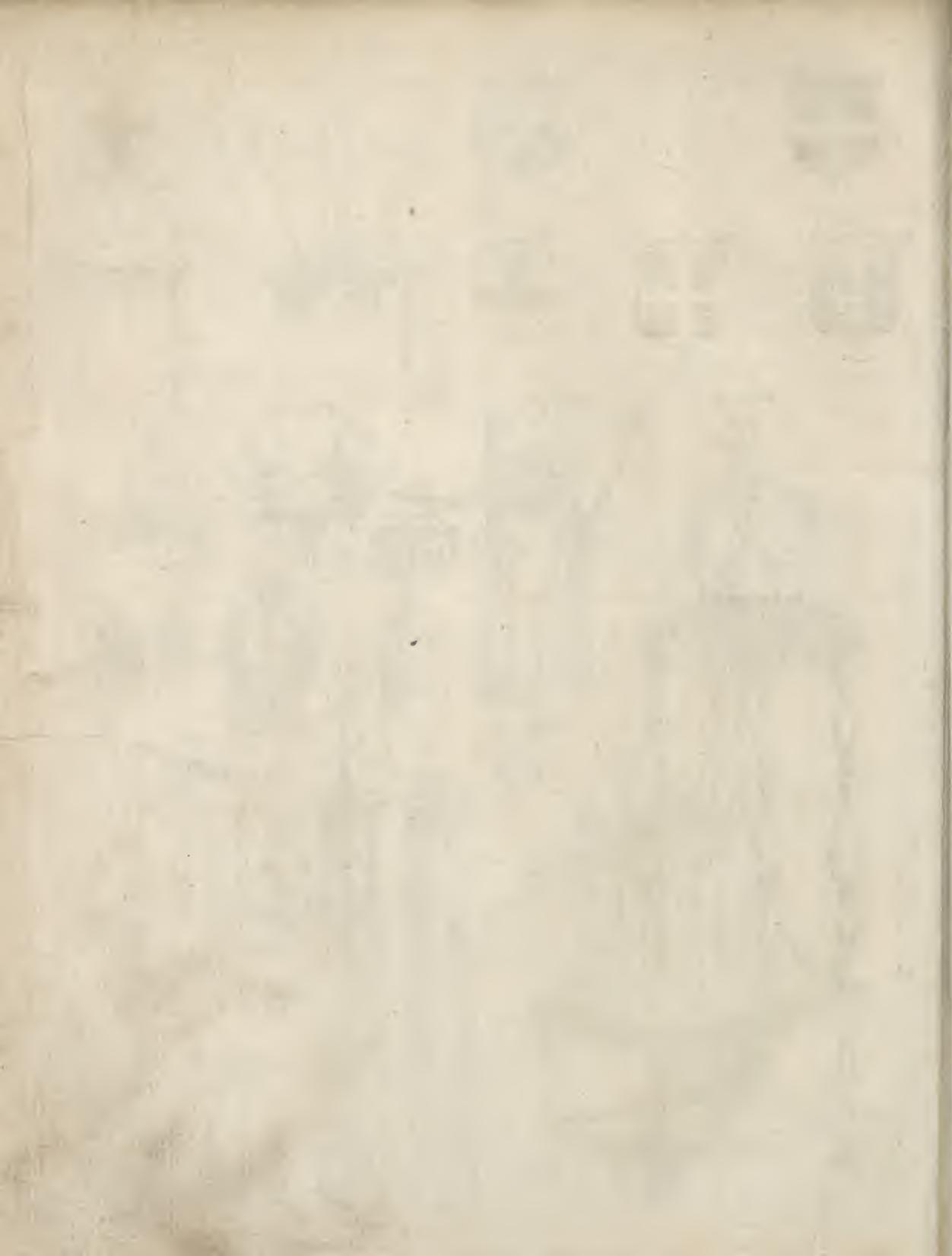


Fig 19



Fig 17





but upon letting the air into the receiver again, to press upon the apple, it will instantly return to its former decayed and shrivelled state.

23. Take a fresh egg, and cut off a little of the shell and film from its smallest end; then put the egg under a receiver, and pump out the air; upon which, all the contents in the egg will be forced out into the receiver, by the expansion of a small bubble of air contained in the great end, between the shell and film.

34. Put some warm beer in a glass; and having set it on the pump, cover it with a close receiver, and then exhaust the air. Whilst this is doing, and thereby the pressure more and more taken off from the beer in the glass, the air therein will expand itself, and rise up in innumerable bubbles to the surface of the beer; and from thence it will be taken away with the other air in the receiver. When the receiver is near exhausted, the air in the beer, which could not disentangle itself quick enough to get off with the rest, will now expand itself so, as to cause the beer to have all the appearance of boiling; and the greatest part of it will go over the glass.

25. Put some warm water in a glass, and put a bit of dry waincot or other wood into the water. Then, cover the glass with a close receiver, and exhaust the air; upon which, the air in the wood having liberty to expand itself, will come out plentifully, and make all the water to bubble about the wood, especially about the ends, because the pores lie lengthwise. A cubic inch of dry waincot has so much air in it, that it will continue bubbling for near half an hour together.

#### OF WINDS.

AS the air is a fluid, subjected to the same laws of gravitation as other fluids, it necessarily has a constant tendency to preserve an equilibrium in every part; so that, if by any means whatever it is rendered lighter in any one place than another, the weightier air will rush in from every side towards this place, till as much be there accumulated as makes it of an equal weight with the rest of the atmosphere: It is these currents of air which are called *winds*.

Many are the causes which may vary the weight of the atmosphere, and occasion particular topical winds.

Although other causes may occasion winds in certain circumstances, yet their principal and most universal cause is the sun, which warmeth the air to a much greater degree in some places of the atmosphere than in others; and as the air is susceptible of a great degree of expansion by heat in those places where it is heated to any considerable degree, it is expanded so much as to become lighter than the air in those places where it is colder; so that the weightier cold air from all the circumjacent parts rushes towards this point to restore the equilibrium which had been destroyed. So that if there be any particular part upon the earth's surface where the sun acts constantly with greater force than on any other part, a current of air will constantly flow from these towards the warmer region: but the sun acts with greater force upon those parts of the earth which are nearest the *Equator*, than those which approach towards either *Pole*; so that we might naturally expect that a wind would constantly blow from the polar regions towards the *Equator*; which is really found to be the case in the *Torrid Zone*, where the influence of the sun overcomes almost all the other lesser causes which produce the variable winds in our

more northerly regions. However, even in the *Torrid Zone*, these north and south winds are varied in different ways.

Although the heat of the equatorial region is greater than any other; yet as the sun acts perpendicularly in his diurnal course upon one point of the equator only at one time, and immediately passes over it; and as the air retains the heat communicated to it by the sun but for a short time, cooling gradually as he retires, and continuing still to decrease till his influence again returns the following day; the degree of heat upon this great circle must be very different in different parts, and perpetually varying in every point; which must in some measure tend to disturb those winds coming from the polar regions, which we have already mentioned. To comprehend clearly what will be the effects of this rotation, let us consider what effect it would naturally produce upon the equator with regard to wind, supposing no other cause should interrupt it. And here we must observe, that as the point upon which the sun acts with the greatest power is constantly moving from east to west, the air to the east of that point over which the sun has more lately passed will be more rarefied than that to the west, and will naturally flow towards that point from east to west with greater velocity than from west to east, as the cool air to the west of that point will be interrupted in its motion towards it by the motion of the sun meeting it. Hence therefore it follows, that from the diurnal motion of the earth from west to east a constant east wind would always be produced, were it not obstructed by other causes. But as there is a constant stream of air flowing from the polar towards the equatorial regions, a composition of these two currents of air acting at the same time will produce a north-east wind in all parts of the northern hemisphere, and a south-east wind in all parts of the southern one. These winds are known by the name of the *general trade-winds*.

If there were no inequalities on the surface of our globe, and if it were composed of a substance perfectly homogeneous, this wind would invariably take place at all times on every part of the earth's surface; but as this is not the case, it is liable to several very considerable variations. In all those regions towards the poles, as the influence of the sun is there but weak, other lesser causes occasion particular winds, and disturb that regularity which at first view we might expect, so that the *general trade wind* does not invariably take place beyond the 28<sup>th</sup> or 30<sup>th</sup> degree of latitude; and the regions between that and the poles have nothing but variable winds. Even in the *Torrid Zone*, there are many causes which in particular places alter this direction of the wind; so that the *genuine trade-winds* do not take place except in the Atlantic and Pacific oceans on each side the equator to the distance of 28 or 30 degrees, and in the greatest part of the Indian ocean to the south of the Equator as appears, more distinctly upon the MAP; see Plate CXLVI. where the course of the winds are marked by the direction of the *strokes*, the *darts* pointing in the same direction as the wind blows.

Having thus explained the nature and causes of the general trade wind, we now proceed to take notice of the principal deviations which take place in the *Torrid Zone*. The general trade-wind, when thus altered at particular seasons, is known by the name of *monsoons*. There are other variations, which, although as general, are yet of smaller and more limited influence. These are known by the name of *breezes*; and as they blow periodically from the sea, they are denominat'd *sea or land breezes*, and take place more

or less in every sea coast within the tropics. As the causes of the monsoons will be more clearly comprehended after the nature of these breezes is explained, we shall first consider them.

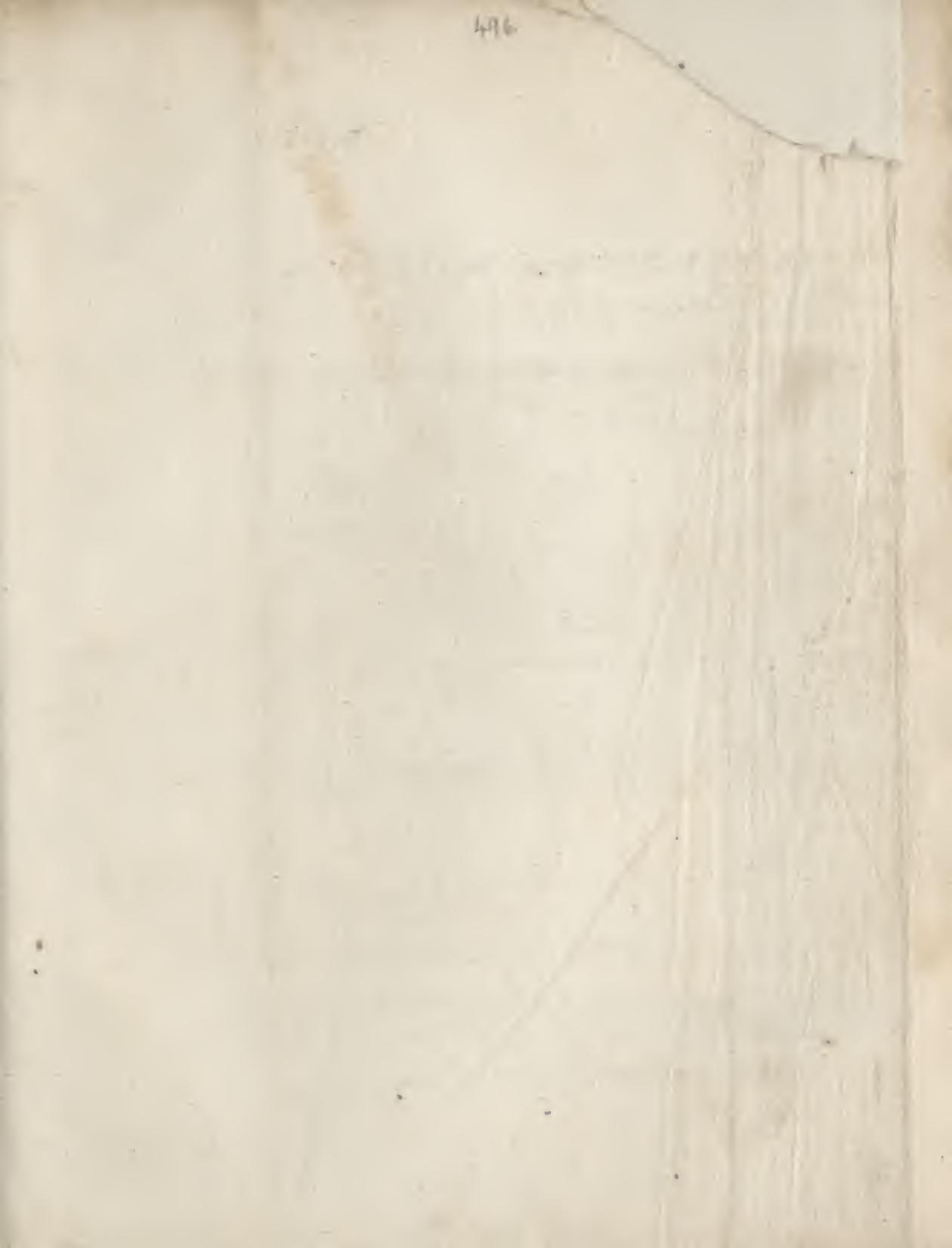
The sea and land breezes of the Torrid Zone are gentle periodical winds regularly shifting twice every day, and blowing from the sea towards the land during the day time, and from the land towards the sea in the night. These breezes do not blow with an equal degree of force throughout the whole day and night, but are perpetually varying, being always strongest about mid-day and midnight, and becoming gradually weaker till the time of change in the evening and morning; about which time the air continues for a short space perfectly calm; but in a little the breeze begins to be felt on the side opposite to that from which it blew last, so faint at first as hardly to be perceived; but by degrees acquiring greater strength, it goes on increasing for five or six hours, after which it again as gradually sinks and dies away. They always blow directly off or towards the shore, and never extend their influence to a great distance from it, although this is varied by particular circumstances in different places; as they never extend so far from the points of capes and promontories, as in deep bays; nor upon the windward, as lee-shores.

These breezes are produced by the same cause which gives rise to the trade-wind, *viz.* the heat of the sun. In these warm regions the days and nights are nearly of an equal length throughout the whole year; the sun rising high in the day time, and descending almost perpendicularly at night; which occasions a much greater variation between the heat of the day and night than is experienced in the more temperate climates; and it is this great difference between the heat of the night and day which produces the breezes. For the rays of the sun are reverberated from the land during the day-time, much more powerfully than from the sea, whose surface is constantly evaporating; and the air above the land is rendered much warmer, and consequently more rarified, than above the sea; so that a current of air necessarily takes place at that time from the sea towards the land, increasing and diminishing in strength as the heat increases or declines. But when the sun descends below the horizon, the evaporation from the surface of the sea is stopt, or greatly diminished, and the cold which it occasioned is of consequence removed: the reverberation of the sun's rays from the surface of the earth is likewise removed, and the air above the land quickly resumes its natural degree of cold, which is always greater than the sea, when the influence of the sun is withdrawn; so that the air above the sea becomes warmer during the night than that above the land, and a current of air is of course established from the land to the sea, which forms the land-breeze, which acts as uniformly, although less powerfully, than the sea-breeze; blowing at first gently as the air begins to cool, and gradually gathering strength as the sun retires below the horizon; till his influence begins to be full again in the morning, when it gradually gives place to the more powerful influences of the sea-breeze. These breezes are not, however, entirely confined to the Torrid Zone. They are even felt in more northern regions: the sea breeze in particular being almost as perceptible during the summer season along the coasts of the Mediterranean and the Levant, both on the African, and European and Asiatic shores, as within the tropics. Even in our own colder climate, the effects of this are often sen-

sibly felt during the summer season; although, from the length of the day and shortness of the night, the difference between the heat of these is far less than in warmer climates; And although the shortness of our nights prevents us from feeling a nocturnal breeze, similar to the land-breezes of the Torrid Zone; yet in every serene evening we have an opportunity of observing a phenomenon, proceeding from a similar cause with that which occasions them in warmer climates. For as the waters retain their heat longer than the earth after the sun withdraws, the moisture which was raised during the heat of the day to a small distance from the earth's surface is quickly condensed by the cold of the evening, and falls down in copious dews; whereas that which is above the surface of the water is more slowly condensed, by reason of the heat which that element retains longer, and hovers at a small distance above it in the form of a dense vapour, which slowly subsides as it loses its heat. This is the cause of those low mists which are so often seen hovering above the surface of rivers and other waters in the evenings towards the end of summer.

It was already observed, that in the Indian ocean the general trade-wind only took place in some parts to the south of the Equator. To the north of the line, and in some places to the south of it in that ocean, the general trade-wind only blows regularly for six months, and during the other six months the wind blows in a direction entirely opposite. It is these winds, which shift thus regularly, which are called *Monsoons*, although they are also sometimes called trade-winds.

At the Equator the days and nights are always of an equal length throughout the whole year; so that the heat being thus equally divided, it never arrives to such an intense degree as to be insupportable to the inhabitants. And as there is no vicissitude of seasons at the Equator, so at the Poles they never experience the more pleasing vicissitudes of day and night, the sun never setting during the summer season, nor rising above the horizon during the winter: and although the day decreases in length as we recede from the pole, from six months to twenty-four hours; yet in all high latitudes the sun descends for such a short space below the horizon, and in such an oblique direction, that the difference between the heat of the day and night is but very inconsiderable. From which it follows, that during this season, when the sun continues to act with such uninterrupted influence upon the surface of the earth, the air will then be rarified more above the dry land than upon the surface of the water; so that a wind would naturally set in at that time from the sea towards the land, similar to the diurnal sea-breezes in the warmer climates; and on the contrary, during the winter season, the air in these northern regions being colder above the land than the water, the winds will naturally blow from the land towards the sea, similar to the land-breezes of the Torrid Zone. But as the influence of the sun, although of longer continuance, is in general more languid in climates of a high latitude than in those near the *line*, it is not to be expected that these effects will follow with the same regularity as in the Torrid Zone: being more apt to be interrupted by lesser causes which affect the atmosphere and produce winds in different directions. Yet these are not so totally interrupted, but that we can easily trace their effects even in our own cold climate: For during the summer season, the large continent to the east of us, being more heated than the Atlantic ocean westward, produces





uces a general tendency of the current of air towards the east, inasmuch that westerly winds are observed to prevail more than any other, not only here, but in all the frontier countries on the continent, during the summer season. And easterly winds become again more prevalent in the winter and spring. On the contrary, it is observed in North America, that the easterly winds prevail more in summer than at any other time; and the west winds always prevail during the cold months of winter. The same effects take place with a greater degree of constancy in other parts of Europe, particularly in Greece, and the countries in that neighbourhood; as the ancient Greeks have particularly remarked, that the winds blew from the south during the heat of summer, particularly about the dog-days, and from the north during the colder weather of winter.

Any attentive reader, who has accompanied us thus far, will readily see, that the monsoons which take place in the Indian ocean proceed from the same general cause. For when the sun, in his annual course, has crossed the line, and comes to act very strongly upon the extensive countries of Arabia, Persia, China, and the other parts of India, these become heated to a much higher degree than the ocean to the south of them; and the air above these extensive countries being so much rarefied, naturally draws the wind towards that place, which, by overcoming the general trade-wind, produces the southerly monsoons which take place in all those seas during the months of April, May, June, July, August, and September. But when the sun has again retreated towards the southern hemisphere, this great degree of heat in these countries subsides, and the genuine trade-wind again resumes its natural course; forming what they call the northerly monsoon, which blows in the months of October, November, December, January, February, and March: and as the continent of Asia now assumes a greater degree of cold than the Atlantic or Pacific oceans in the same latitude, it produces a brisker and more steady gale during the continuance of this monsoon, than is ever experienced in the general trade wind.

Having thus explained the nature of the monsoons in general, we shall proceed to consider the particulars which influence the direction of these in those parts where they take place. In all that part of the Indian ocean which lies between the island of Madagascar and Cape Commorin, the wind blows constantly from the W. S. W. between the months of April and October; and in the opposite direction from the month of October till April, although with some variation in different places, as these winds are neither so strong nor constant in the Bay of Bengal as in the Indian ocean. And it is likewise remarkable, that the S. W. winds in these seas are generally more southerly on the African side, and more westerly on the Indian, as appears distinctly in the map. But these variations are not repugnant to the general theory. For it is sufficiently known, that high lands in every part of the globe are much colder than low and flat countries; and as that part of Africa is very high and mountainous, the cold in these regions is much greater than in the more flat countries of Arabia and India; so that the wind naturally blows from these cold regions, in the summer season, towards the warmer continent of Asia; which occasions those inflections of the wind to the eastward which take place in these seas during the summer months; and is still farther assisted by the peninsula of India, the kingdom of Siam, and the islands of Sumatra and Java,

on the eastern part of this ocean, lying so much farther south than the kingdom of Arabia and Persia; so that these, being more heated than the ocean to the westward, naturally draw the wind towards them, and produce the easterly variation of the monsoon which takes place in this part of the ocean, while the warm and sandy deserts of Arabia draw the winds more directly northward near the African coasts.

In the eastern parts of the Indian ocean, beyond the island of Sumatra, through the gulf of Siam and bay of Tonquin, and along the southern parts of China, and among the Philippine islands, &c. to the north of the Equator, the monsoons observe a different direction, blowing nearly due south and north. Here the greatest part of the warm continent is to the west of this district, which makes the wind naturally assume this direction. A little to the east of this, among the Mariamne islands, the general trade-wind takes place, there being no continent to the north of them to occasion monsoons.

The monsoons are as regular in the eastern part of the Indian ocean to the south of the Equator, as they are to the north of it; as here a northern monsoon sets in from the month of October till April, and a southern from April till October. And here, as to the north of the line, we find the direction of the monsoons varying according to particular circumstances in different places: for about the island of Sumatra, and towards the west end of Java, the monsoons set in nearly from the north and south; but toward Celebes and Timur, they begin to tend a little more to the east and west, gradually declining as they approach the coast of New Guinea, near to which the northerly monsoon from October till April blows from the N. W. and the opposite monsoon from the S. E. between October and April. The reader will easily perceive that these monsoons are occasioned by the continent of New Holland and Guinea, which being heated by the sun when in the southern signs, draws the wind towards that in the summer season, in the same manner as the continent of Asia produces the monsoons to the north of the line. And it is likewise sufficiently plain, that the inflection of these periodical winds about Celebes and Timur is occasioned by that part of the continent called New Guinea jutting out so near to the Equator to the east of these, and drawing the wind toward that quarter.

These are the most general and extensive monsoons which take place in our globe. But there are other periodical winds, which occur in particular places in these warm regions, that deserve particular attention.

In the Red-Sea, the monsoon shifts as regularly as in other places; but being influenced by the coasts, it tends a little more to the north and south than in the Indian ocean.

On the south coast of Africa, to the south of C. Corientes, and about the southern parts of the island of Madagascar, the regular trade-wind from the S. E. takes place between October and April; but from April till October the wind blows from the W. or N. W. and is at that season exceedingly cold. This is evidently occasioned by a cause already taken notice of: for, notwithstanding the high and cold nature of this continent, yet when the sun is to the south of the line, his powerful influence at that season so far abates their natural degree of cold, as not to interrupt the general trade-wind between the months of October and April: But when he returns to the northern hemisphere, the high mountains of Africa resume their native coldness, and repel the general trade-winds by their cold and more powerful

ful blast, so as to produce the intemperate monsoon which here takes place between the months of *April* and *October*.

From *Mozambique*, to cape *Guardafoy*, at the mouth of the *Red Sea*, the monsoons are a little more irregular than in the other parts of the *Indian ocean*. For it is observed, that between *October* and *January* the winds are variable, although chiefly from the north. In *January* the N. E. monsoon sets in, and continues regular till the month of *May*. From *May* till *October* the winds again become variable, but blow chiefly from the southern points; but in the months of *June*, *July*, and *August*, there are frequent calms, especially about the bay of *Melinda*, which sometimes continue for several weeks together, and extend only about a hundred leagues from shore.

Before we can explain the cause of this irregularity clearly, it will be necessary to attend to the direction of the wind on each side of this track at each particular season. In the months of *October*, *November*, and *December*, the winds are here variable, but chiefly from the north. Now during these three months, the wind to the south of this beyond *C. Corientes* blows from the S. E. at the *Red Sea*, and all to the north of this the wind during this season of the year is from the N. E. And as the sun is then perpendicular to the bay of *Melinda*, these opposite winds here meeting and opposing one another, and being both of them stopt in their course westward by the cold regions of *Africa* near the Mountains of the Moon, will naturally produce the variable winds here observed according as the one or the other of these three balancing powers shall predominate: although, as the coast here runs away towards the south-west, it is natural to expect that the northerly wind, which follows the same direction, should more frequently prevail than those which are opposed by it; especially when we consider, that the island of *Madagascar*, now beginning to be warmed by the influence of the sun, will concur in drawing the wind to the southward; and when the continent of *Africa* is more heated in the months of *January* and *February*, it does not oppose the easterly monsoon, so that the winds become then more fixed than before. But in the months of *June*, *July*, and *August*, the wind to the south of *C. Corientes* is from the N. W.; and near the *Red Sea*, and throughout the northern part of the *Indian ocean*, the S. W. monsoon is then in its greatest vigour; so that on each end of this district the wind is blowing in an opposite direction; from which results these calms about *Melinda*, which we just now mentioned.

This much may suffice for the shifting winds on the *African* and *Asiatic* coasts. As to *America*, the only places where the wind shifts regularly are, the bays of *Honduras* and *Campeachy* on the east, and that of *Panama* and some parts on the coast of *Mexico* on the west, with a small track upon the coast of *Brazil*. In the south part of the bay of *Honduras*, between *C. Gratia de Dios* and *C. la Bela*, the common trade-wind between E and NE blows between *March* and *November*; from *October* till *March*, there are westerly winds; not constant or violent, but blowing moderately sometimes two or three days or a week; and then the easterly breeze may again prevail for an equal length of time. The reason of the peculiarity here observed is this. During the summer season, the high land on the *Isthmus of Darien* is so much warmed as not to interrupt the course of the general trade-winds. But

when he retires to the southern hemisphere, the cold upon the *Isthmus* at that season becomes so great, as to condense the air to such a degree as to repel the trade-wind for some time: but not being cooled to such an intense degree as in some of the larger continents, the trade-wind, at times overcomes and repels these land breezes in its turn, and produces the phenomena above described. And that this is really the case, appears evident from this circumstance, that the land-breezes are most prevalent and of longest duration in the coldest months of *December* and *January*; before and after which two months, the trade-wind being generally checked, only a day or two about the full or change of the moon. As these western breezes on this coast take their rise from the same cause as the diurnal land-breeze in warm climates, they may be considered as land-breezes of two or three days continuance, and forming an intermediate step between the land-breezes and monsoons. Although the influence of these breezes is felt farther off at sea than the common diurnal breeze, yet they do not extend a great way, being seldom felt above twenty or thirty or forty leagues from shore; and about *C. La Vela*, which is much exposed to the east wind, these breezes seldom extend above eight or ten leagues from shore. Land breezes of the same nature, and proceeding from similar causes, are also experienced in the winter season in the bay of *Campoachy* which are there known by the name of *Summasenta* winds. Beyond *C. la Vela* these western breezes are not felt, which is undoubtedly occasioned by the whole of that coast as far as *C. St Augustine* being so much exposed to the general trade-wind, which here sweeps along the coast with so much violence as almost totally to repress the weaker influence of the breezes. But between *C. St Augustine* and *St Catharine's island*, or a little farther, we again meet with a variation of the wind at different seasons, as it is here observed to blow in an E or NE direction from *September* till *April*; and from *April* till *September* from the SW. This variable wind, or monsoon, like the others on this coast, extends but for a very short way from shore, and is evidently occasioned by the same causes as the other periodical winds. For, in the summer-months, (which in this climate is between *September* and *April*, the land of the continent being heated by the sun, draws the trade-wind from its common course of SE, a little to the westward; and as the coast here tends towards the SW, the wind in some measure (as it always does) follows the same direction, and produces this ENE monsoon. But, in the winter, when this region becomes more cool, the east wind is repelled by the dense cold air from the mountains; by which means it is bent to the northward, and is forced along the coast to *C. St Augustine*; where meeting with no further hindrance, it again falls in with the general trade-wind, and is carried along with it in its proper direction.

We have purposely omitted mentioning the winds on the west coasts of *Africa* and *America*, till the others were explained, as the causes of the peculiarities here observed will be now more easily comprehended. On the coasts of *Chili* and *Peru*, in *America*, from 25° or 30° of south latitude to the line; and on the parallel coast of *Angola*, &c. in *Africa*, the wind blows all the year from the south, varying in its direction a little in different places according to the direction of the coast, towards which it always inclines a little. But whatever is the direction at any one place, it continues the same throughout the whole year without any

any variation, and always blows from some southerly point. But there is this difference between this wind upon the coasts of *Chili* and *Angola*, that it extends much farther out to sea upon the former than upon the latter.

In order to explain the cause of this singular phenomenon, it is necessary to recollect, that the general trade-wind is produced by the concurrence of two separate causes. One is the great heat of the equatorial region, by which alone would be produced a constant north or south wind. The other is the diurnal revolution of the earth, which would cause a perpetual tendency of the air in these warm regions from east to west. From the concurrence of these two causes result the general trade-wind, which would constantly blow from the SE or NE, as we have already demonstrated. But if any one of these two causes, in any particular place, is prevented from producing its full effect, while the other continues to exert its influence, the general direction of the wind will be varied, and it will assume another. Thus, if the east wind was prevented from acting in any particular place, while nothing interrupted the south or north wind, it is evident that the air would rush towards the equator in that direction which was nearest and easiest, whether that should be pointing eastward or westward. Now as the high mountains in the internal parts of *Africa* and *America* interrupt the course of the east wind near the surface of the earth, while these coasts of which we now treat are entirely open to the south, the wind naturally rushes along the coasts of *Chili* and *Angola* from north to south; and as the low lands near the shore, in these warm regions, is generally warmer than the sea, the wind will naturally point in towards the shore, as is generally observed to happen.

This, then, is the obvious cause of the south wind which always prevails upon the coasts of *Chili* and *Peru*, as well as along the shores of *Angola*, *Loango*, &c. But it is only near the shore that this can take place; nor can it extend to a great height above these low and fertile regions. For as the internal parts of these countries are exceedingly high; but more especially the *Andes of America*, which experience a perpetual degree of cold more intense than some polar regions ever experience; the air must here be condensed to a very great degree, and send forth from these high regions a perpetual wind to every side, which occasions almost all the peculiarities that have been remarked in these climates: For by opposing the general current of the trade-wind upon the eastern part of these continents, they produce these deluges of rain which supply the immense rivers of the *Amazons*, *La Plata*, &c. these do not, like the *Nile* and *Gambia*, swell only at a particular season, and then shrink into a diminutive size again, but continue throughout the whole year, with less variation of size, to pour their immense floods of water into the ocean. These cold winds likewise stretching to the westward, at a considerable distance above the warmer regions of the sea-coast, at length descend as low as the ocean, and form the general trade-wind, and occasion that unusual degree of cold which mariners have so often complained of even under the line to the westward of *America*. To the same cause also must we attribute the thick fogs so common upon the southern parts of *Chili* and along the coasts of *Peru*, with the other peculiarities of that singular climate: about *Lima* and the kingdom of *Valley* in South America; for the vapours which are exhaled in such great abundance in the warm regions on the

sea shore, are, at a little height above the earth, condensed by the cold winds which come from the mountains, and form these thick mists which are so often observed in this climate. The same effects are felt in some degree on the similar coast of *Africa*. But as the mountains of *Africa* are not so high as the *Andes of America*, nor approach so near the western coast, the effects are less sensible here than in *America*. The great height of the *Andes* above the mountains of the similarly situated country of *Africa*, is the only reason why the effects on that coast are not felt to an equal degree, although similar in kind.

A more singular deviation from the general trade-wind is observed to take place on the *African* and *American* coasts to the north of the line, than those we have taken notice of to the south of it. For it is observed, that from *California* to the bay of *Panama*, all along the coasts of *New Spain*, the winds blow almost constantly from the west or SW, nearly directly opposite to the trade-wind; and on the coast of *Africa* from *C. Boyador* to *C. Verde*, they blow chiefly from the NW, standing in upon the shore; from thence the wind bends gradually more and more from the north to the west, and so round to the SW, all along the coast of *Guinea*, as will be distinctly seen by the map. After what we have said of the winds on the southern parts of these regions, it will be unnecessary to spend much time in explaining the cause of these peculiarities, as it will evidently appear that they are nearly the same, the variations here observed being occasioned by the particular direction of the coast. Thus, along the coast of *New Spain*, the wind blows nearly the same direction in every place, as there are no remarkable bendings on the coast; being uniformly drawn towards the shore, by the great heat of the low part of the continent near the sea; which in these regions is always more heated than the water of the ocean, and occasions that inflection. But as the coast of *Africa* is more irregular, the winds also are found to be more different in their direction. To the north of *C. Verde*, as the coast stretches nearly south and north, the wind, being drawn towards it a little, blows from the NW. But beyond that, the coast bends more eastward to *C. Palmas*; from which it runs E or NE all along the coast of *Guinea*, the wind shifting gradually more and more to the west, still pointing in upon the coast. And as there is nothing to oppose the current of air, which comes from the south, along the coast of *Angola*, it stretches forward till it comes within the influence of the coast of *Guinea*, and is there drawn in towards the shore in a SW direction. But as it is only the lower regions of the coast of *Guinea* which are so much warmed, the high mountains within continuing cold; the northerly wind coming from these meeting and opposing the southerly winds in the higher regions of the air, by their mutual conflicts occasion those incessant rains and tremendous thunder so remarkable along the whole of this uncomfortable coast.

It has been often observed by mariners, that there is a track of sea to the west of *Guinea* from five to ten degrees of north latitude, in which the trade-wind blows with less steadiness than in any other part of that ocean, being almost constantly troubled with calms and tornadoes; the cause of which the reader will perceive by inspecting the map; as he will easily see that the winds are drawn from this quarter almost in every direction; so that there can be here no constant wind; but being exhausted of its air, it must become lighter than the circumjacent parts, and must then be sup-

plied

plied from either side, as chance or occasional circumstances may direct, which occasions those sudden flurries and tornadoes here observed.

Before we take our leave of this subject, it is necessary to observe, that in the Bay of *Panama*, the winds between *September* and *March* are easterly; but from *March* till *September* they blow chiefly from the SSW; that is, during the winter months, while the sun is far from them, the winds are off shore; and during the summer months, the land being heated to a considerable degree, they are drawn towards the shore as usual. It is remarkable, however, that this is the only part on the west of a large continent where the wind shifts regularly at different seasons; which seems to be occasioned by the great height of the *Isthmus of Darien*, and the *Terra Firma* to the east of it, and the nearness of these to the sea, in comparison of the mountains near *Benin* on the similarly situated coast of Africa; which is greatly assisted by the deepness of the bay, which, by bending so much to the eastward from *C. Lorenzo*, is in a great measure screened from the force of the south winds, which allows the winter breeze to extend itself upon the bay with more facility. We ought here also to remark, that along the coast of *Mexico*, between *C. Pelanco* and *Guatemala*, there are land winds which blow in the months of *May*, *June*, and *July*, called by the Spaniards *Popoaios*. They greatly resemble the *Summasenta* winds in the *Bay of Campeachy*, as they blow both night and day a moderate breeze without intermission, sometimes three or four days or a week together. But as these blow from the land in summer only, whereas the *Summasenta's* blow only in winter, they must be occasioned by a different cause; which seems to be this: As the continent which divide the *south sea* from the *Bay of Mexico* and *Gulf of Honduras*, is but of very small breadth, and in many places very high ground, the heat which it receives from the sun in summer is not so great as on the similar coast of Africa; and as the trade-wind coming from the great *Atlantic* ocean sweeps along the eastern part of the *American* coast from *C. St Augustine* to the *Bay of Honduras* with very great violence at that season, the small heat of this narrow continent, is not sufficient to stop it entirely during that season; so that at some times it blows for a short time quite across it, and occasions those winds called *Popoaios*.

Besides these more general winds, there are likewise some particular winds which are only felt in particular places at certain times, whose effects are so singular as to merit attention; some of which we shall here take notice of. In the *Gulf of Persia*, particularly at *Ormuz*, during the months of *June* and *July*, there sometimes blows from the west, for a day or two together, a hot suffocating fiery wind, which scorches up and destroys any animal that may be exposed to it; for which reason, almost every body leave their habitations at *Ormuz* during these two months, and retire to the mountains near *Schiras* in *Persia*, where they enjoy a more comfortable climate. To explain the cause of which, it is necessary to observe, that along all the coasts of *Asia*, to the north of the *Indian ocean*, the diurnal sea and land breezes take place, as in every part of the torrid zone; by means of which, the monsoons are not felt close in upon the shores. But as the monsoon continues to blow regularly at a small distance from shore, so in all probability it continues its course without interruption at a small distance above the surface of the earth. Now when the monsoon is in its greatest vigour, its influence will sometimes de-

scend even as low as the surface of the earth, and interrupting the course of the breezes, hurry along with it these warm vapours, which ought to have ascended upwards, and produced the salutary sea-breeze; and as the earth is thus deprived of the refreshing influence and moisture of the sea-breeze, the air, by the strong reverberation of the sun-beams from such dry and sandy countries as *Arabia*, must soon be heated to an amazing degree, and produce these hot and suffocating winds. It is also remarkable, that these hot winds are more often experienced near headlands, where the sea-breezes are weakest, which seems to confirm this hypothesis. Winds similar to these in kind, though not in degree, are felt upon the coast of *Coromandel* during the months of *June*, *July*, and *August*, while the west monsoon reigns; and on the *Malabar* coast they are likewise felt in the months of *December* and *January*, while the east monsoon reigns; but these are much less powerful than either of the others. As these hot winds always come from the land, they are known upon these coasts by the name of *Terreno's*.

It has likewise been observed, that on the coast of *Africa* to the north of *C. Verde*, during the months of *December*, *January*, and *February*, there sometimes blows, for a day or two together, an easterly wind, so very intensely cold as to be almost as destructive as the warm winds at *Ormuz*. We have already in some measure explained the cause of this phenomenon. During these months, when the sun is far from them, his influence is less felt than at other seasons, and the northerly wind upon the coast is of course weakened, inasmuch that the cold produced by the mountains in the heart of the country being now in its greatest degree of force, bursts its usual confinement for a time, spreading to the west with great violence, and producing those uncommon effects already mentioned. Those who sail on these coasts, distinguish this particular wind by the name of *Hermatan*.

These are the principal winds, whether constant or periodical, that take place within the *tropics*; and thus simple are their causes.

The succession of sea and land breezes renders the *Torrid Zone* not only habitable but comfortable. Besides, as these currents of cold air, rushing from each side of the globe, and carrying along with them vast quantities of aqueous vapours which they collect from the surface of the earth in their course, meet and oppose one another at that part of the atmosphere where the influence of the sun is greatest at the time, the water is there forced from the clouds in such prodigious quantities, as to produce a diversity of seasons in the *Torrid Zone*, something similar to what is experienced in more temperate climates; with this difference however, that whereas, in temperate climates, the warmest and most comfortable season is when the sun approaches nearest perpendicular to them, in these warmer climates the heavy rains which fall upon them at that season moderates the heat, and prevents the sun from having such an effect as at other times; so that their coldest and most inconstant weather, which they call *winter*, is at that season, when, without this cause, they would be exposed to the sun's most powerful influence.

We shall only take notice of one other instance of the happy effects produced on our globe, by the laws of nature with respect to winds. We have seen, that in the great *Atlantic* and *Pacific* oceans, the trade-wind blows constantly from the easterly points throughout the whole year, so that

ships sail from *east* to *west* within the tropics with the utmost facility; but it is absolutely impossible in these seas to sail from *west* to *east*, as the wind would be constantly against them, so that ships bound for any part to the *eastward* in these regions, must stand to the *north* or *south* till they are beyond the limits of the *trade-winds*, where they meet with *variable breezes*, by the help of which they sail to the *eastward*. But if the same constant *trade-wind* had taken place in the northern part of the *Indian Ocean*, it would have been impossible to have sailed to the *eastward* at all; because the continent of *Asia* would have prevented the ships from sailing far enough north to find the variable winds. But here, as in almost every case in which the operations of nature are concerned we find, that what produceth the disease, at the same time furnisheth a remedy: for that very continent which would have stood in our way going northward,

draws the wind towards itself at one season, which makes that course of navigation unnecessary, the shifting of the *monsoons* supplying a nearer and more commodious course. Thus we see, that where ever the sea is open to the south or north, near the *tropics*, so as that ships are at freedom to reach the *variable winds*, the *trade-wind* constantly blows in one direction; but where ever there is any extent of continent within the verge of the *Torrid Zone*, so as that they could not be at liberty to reach the variable winds, there the course of the *trade-wind* is altered, being drawn towards it in summer, and from it in winter, forming that shifting wind called *monsoons*. From which we may naturally infer, that as there are no *monsoons* in the *Pacific* or *Atlantic*, or in the western part of the *Indian ocean*, to the south of the *line*, there are no extensive continents near the tropics in either of these places.

## P O E

**PNEUMATOCELE.** See **MEDICINE** and **SURGERY**.  
**PNEUMONICS**, in pharmacy, medicines proper in diseases of the lungs, in which respiration is affected.  
**PO**, a great river of Italy, rising in the Alps, and running first east, soon after turns directly north, through Piedmont, where it receives the *Doria*; then passing north east, it discharges itself by several channels into the gulph of Venice.  
**POA**, in botany, a genus of the triandria digynia class. The calix has two valves including several flowers; the spike is oval, with pointed valves. There are 20 species, twelve of them natives of Britain.  
**POCHARD**, in ornithology. See **ANAS**.  
**PODAGRA**, in medicine, the gout in the feet. See **MEDICINE**.  
**PODALIA**, a province of Poland, bounded by Volhinia, and the Russian *Ukrain*, on the north and north-east; by Budziac *Tartary*, on the south-east; by the river *Niester*, which separates it from *Bessarabia* and *Moldavia*, on the south-west; and by the province of *Red-Russia*, on the north-west.  
**PODENSTIEN**, a town of Germany, in the circle of *Francia*: situated in E. long. 11° 35', N. lat. 49° 50'.  
**PODEX**, in anatomy. See **ANUS**.  
**PODOPHYLLUM**, in botany, a genus of the polyandria monogynia class. The corolla has nine petals, and the calix three leaves; the capsule is oval and unilocular. There are two species, none of them natives of Britain.  
**POEM**, a composition in verse of a due length and measure.  
 Poems are generally denominated from the subject-matter, as the *apobaterion*, *epibaterion*, *epinicion*, *epithalamium*, *genethliac*, *elegiac*, *satiric*, *epitaph*, *panegyric*, *lyric*, *pastoral*, &c. and others from the manner of narration, as *epic*, *dramatic*, &c. to which may be added *odes*, *eclogues*, and *idylliums*. To this head may also be referred several other compositions of a less serious kind, as the *acrostic*, *enigma*, *anagram*, *certo*, *echo*, &c.  
**POET**, the author of a poem. See **POEM**.  
**POETRY**, the art of composing poems, or pieces in verse; or, as defined by *Vossius*, the art of representing actions in metre.

## P O E

*Vossius* thinks that love was the first occasion of poetry; which is not improvable, considering that this affection is coeval with mankind, is universal, and naturally productive of poetry. Yet it undoubtedly owes its increase and progress to religion. *Dacier* indeed calls it the offspring of religion; and it is certain, in the earliest ages of the world, that it was usual to sing hymns to the honour of the gods upon solemn festivals. *Du Bos* thinks that poetry has been employed in all ages, even by the most unpolished nations, to preserve the memory of past events. Its principal aim is to flatter our senses and imagination: for, according to *Plato*, it awakes the spiritual empire of the soul. Every kind of poetry charms us in proportion to its object, says *Du Bos*: and to be very affecting, it ought to be very exact. It is not the same with poetry as with other arts; for an ignorant person may judge of poetry by the impression it makes on him: whence all men have a right to give their opinion concerning a piece of poetry; and this judgment ought to be founded on experience rather than on argumentation. Poetry is an art where every thing should please. It is not enough to exhibit nature, which in certain places and circumstances is rude and unpleasant: but the poet must chuse in her what is beautiful from what is not: whence a poet ought to chuse, for the subject of his imitation, something that is naturally affecting. There is a particular rhetoric for poetry, which consists in discerning very precisely what ought to be said figuratively, and what to be spoken simply; and in knowing where ornament is required, and where not: yet the style should be copious, and every species of writing in this art should have a diction proper to itself. The qualifications, then, necessary for poetry, or those which form a good poet, are seldom found united in one person: he must have an extraordinary genius, great natural gifts, a wit just, piercing, solid, and universal; an understanding clear and distinct; an imagination neat and pleasant; an elevation of soul that depends not on art, or study, and which is purely a gift of heaven, and must be sustained by a lively sense and vivacity, a great judgment to consider wisely of things, and a vivacity to express them with that grace and abundance which gives them beauty. In fine, to accomplish a poet, is required a temperature of wit and fancy, of strength and sweetness, of penetration and delicacy; but, above

- AN**, he must have a sovereign eloquence, and a profound capacity. These are the qualities that must concur together to form the genius of a poet, and sustain his character.
- POICTIERS**, the capital of Poictou, in France, situated on an eminence, near the river Clain: E. long. 15', N. lat. 46° 40'.
- POICTOU**, a territory of France, in the province of Orleansois, situated south of the river Loire, being bounded by the provinces of Anjou and Brittany on the north, by Touraine and Berry on the east, by Santoign, Angoumois, and Auais on the south, and by the ocean on the west. It is one hundred and fifty miles long, and seventy broad.
- POINCIANA**, in botany, a genus of the decandria monogynia class. The calix consists of five leaves, and the corolla of five petals; the stamina are long. There are three species, all natives of India.
- POINT**, a term used in various arts.
- POINT**, *punctum*, in geometry, as defined by Euclid, is a quantity which has no parts, or which is indivisible.
- POINT**, in grammar, a character used to mark the divisions of discourse.
- POINTS**, in heraldry, are the several different parts of an escutcheon, denoting the local positions of any figure. There are nine principal points in an escutcheon, as represented in Plate CXLV. fig. 2. where A shews the dexter chief; B, the precise middle chief; C, the sinister chief; D, the honour-point; E, the fess-point, called also the centre; F, the nombril-point, that is, the navel-point; G, the dexter base; I, the sinister base; H, the precise middle base.
- POISON**, in medicine. See **MEDICINE**, p. 152.
- POLAND**, a large kingdom of Europe, situated between 16° and 34° east longitude, and between 46° and 57° north latitude; bounded by Russia on the north and east; by Bessarabia, Moldavia, Transilvania, and Hungary, on the south; and by Pomerania, Brandenburg, and Silesia, on the west; being almost square, and seven hundred miles over either way.
- POLAR**, in general, something relating to the poles of the world, or poles of the artificial globes: thus we meet with polar circles, polar dial, polar projection, &c.
- POLARITY**, the quality of a thing considered as having poles; but chiefly used in speaking of the magnet.
- POLE**, in astronomy, one of the extremities of the axis on which the sphere revolves.
- POLE**, **PERCH**, or **ROD**, in surveying, is a measure containing sixteen feet and a half.
- POLE**, or **POLAR STAR**, is a star of the second magnitude, the last in the tail of ura minor. See **ASTRONOMY**, p. 486.
- POLE CAT**. See **MUSTELA**.
- POLEMICAL**, in matters of literature, an appellation given to books of controvery, especially those in divinity.
- POLEMONIUM**, in botany, a genus of the pentandria monogynia class. The corolla consists of five segments; the stigma is trifid; and the capsule has three cells. The species are five, only one of which, *viz.* the cæruleum, or great valerian, is a native of Britain.
- POLIANTHES**, in botany. a genus of the hexandria monogynia class. The corolla is bell-shaped; and the filaments are inserted into the faux. There is but one species.
- POLICY**, or **POLITY**, in matters of government. See **POLITY**.
- For policies of assurance, or insurance on ships, houses, lives, &c. see **INSURANCE**.
- POLISHER**, or **BURNISHER**, among mechanics, an instrument for polishing and burnishing things proper to take a polish. The gilders use an iron-polisher to prepare their metals before gilding, and the blood-stone to give them the bright polish after gilding.
- POLISHING**, in general, the operation of giving a gloss or lustre to certain substances, as metals, glass, marble, &c. See **METAL**, **GLASS**, &c.
- POLITICS**, the first part of œconomy, consisting in the well governing and regulating the affairs of a state, for the maintenance of the public safety, order, tranquillity, and morals.
- POLITY**, or **POLICY**, denotes the peculiar form and constitution of the government of any state or nation; or, the laws, orders, and regulations, relating thereto. Polity differs only from politics, as the theory from the practice of any art.
- POLL**, a word used in ancient writings for the head: hence to poll, is either to vote or to enter down the names of those persons who give in their votes at an election.
- POLLACK**, in ichthyology. See **GADUS**.
- POLLEX**, in anatomy, denotes either the thumb or great toe, according as either manus or pedis is added to it. See **ANATOMY**.
- POLLUX**, in astronomy, a fixed star of the second magnitude in the constellation gemini, or the twins. See **ASTRONOMY**, p. 487.
- POLOCZK**, the capital of the palatinate of the same name, in the duchy of Lithuania, in Poland: E. long. 29°, N. lat. 56° 30'.
- POLYACANTHA**, in botany. See **CARDUUS**.
- POLYADELPHIA**, in botany. See **BOTANY**, p. 635.
- POLYANDRIA**, in botany. See **BOTANY**, p. 635.
- POLYANTHUS**, in botany. See **PRIMULA**.
- POLYCHREST**, in pharmacy, signifies a medicine that serves for many uses, or that cures many diseases.
- Sal* **POLYCHREST**, a compound salt made of equal parts of salt-petre and sulphur, laid on a red-hot crucible.
- POLYCNEMUM**, in botany, a genus of the triandria monogynia class. The calix consists of three leaves, and the corolla of five petals; and it has but one round seed. There is but one species, a native of Germany.
- POLYGALA**, in botany, a genus of the diadelphia octandria class. The calix consists of five leaves; and the pod is cordated, and has two cells. There are 24 species, only one of them, *viz.* the vulgaris, or milk-wort, a native of Britain.
- POLYGAMIA**, in botany. See **BOTANY**, p. 635.
- POLYGAMY**, a plurality of wives or husbands, in the possession of one man or woman, at the same time.
- Many arguments have been offered to prove the unlawfulness of polygamy; one of the principal of which is, that the males and females brought into the world are nearly on a balance; only abating for a small excess on the side of the males to make up for the extraordinary expence thereof in war and at sea: whence it evidently follows, that nature only intends one wife, or one husband, for the same person; since if they have more, some must go without any at all. Hence it is justly concluded,
- that

- that the Christian law, which prohibits polygamy, is more agreeable to the law of nature than the Mahometan, and, we may add, than the Jewish law, by which polygamy was tolerated.
- POLYGLOTT**, among divines and critics, chiefly denotes a bible printed in several languages. See **BIBLE**.
- POLYGON**, in geometry, a figure with many sides, or whose perimeter consists of more than four sides at least: such are the pentagon, hexagon, heptagon, &c.
- POLYGONATUM**, in botany. See **CONVALLARIA**.
- POLYGONUM**, in botany, a genus of the octandria trigynia class. It has no calix; the corolla has five segments; and there is but one angular seed. The species are 27, eleven of them natives of Britain.
- POLYGYNIA**, among botanists. See **BOTANY**, p. 635.
- POLYHEDRON**, in geometry, denotes a body or solid comprehended under many sides or planes.
- POLYHEDRON**, in optics, is a multiplying glass or lens, consisting of several plane surfaces disposed into a convex form. See **OPTICS**.
- POLYMATHY**, denotes the knowledge of many arts and sciences.
- POLYMNIA**, in botany, a genus of the syngenesia polygamia necessaria class. The receptacle is paleaceous; it has no pappus; and the calix consists of ten leaves. There are two species, both natives of America.
- POLYPUS**, in zoology, a species of the hydra, which, although cut in a thousand pieces, and in every direction, still exists, and each section becomes a complete animal.
- POLYPETALOUS**, among botanists, an epithet applied to such flowers as consist of several petals, or flower-leaves.
- POLYPODIUM**, in botany, a genus belonging to the cryptogamia filices class. The fructifications are disposed in round spots on the margin of the leaf. There are 65 species, 14 of them natives of Britain.
- POLYPREMUM**, in botany, a genus of the tetrandria monogynia class. The calix consists of four leaves, and the corolla, which is rotated, of four segments; the capsule is compressed, and bilocular.
- POLYPUS of the heart**. See **MEDICINE**, p. 158.
- POLYSYLLABLE**, in grammar, a word consisting of more syllables than three; for when a word consists of one, two, or three syllables, it is called a monosyllable, dissyllable, and trisyllable.
- POLYTHEISM**, in matters of religion, the doctrine or belief of a plurality of gods.
- POLYTRICHUM**, in botany, a genus of the cryptogamia musci class. The anthera is operculated, and the calyptra hairy. There are three species, one of them, *viz.* the commune, or great golden maidenhair, a native of Britain.
- POMEGRANATE**. See **PUNICA**.
- POMERANIA**, a province of Upper Saxony, in the north of Germany; bounded by the Baltic-sea, on the north; by Poland, on the east; by another part of Poland, and Brandenburg, on the south; and by the duchy of Mecklenburg, on the west.
- POMME**, or **POMMETTE**, in heraldry, is a cross with one or more balls or knobs at each of the ends.
- POMMEL**, or **PUMMEL**, in the ménage, a piece of brass, or other matter, at the top and in the middle of the saddle-bow.
- POND-WEED**, in botany. See **POTAMOGETON**.
- PONDICHERRY**, a town of India, on the Coromandel-coast, sixty miles south of Fort St. George.
- PONTEDERIA**, in botany, a genus of the hexandria monogynia class. The corolla consists of one bilabiate petal cut into six segments; and the capsule has three cells. There are three species, none of them natives of Britain.
- PONTEFRACT**, a borough-town, eighteen miles south-west of York. It sends two members to parliament.
- PONTIFICATE**, is used for the state or dignity of a pontiff, or high-priest; but more particularly, in modern writers, for the reign of a pope.
- PONTON**, or **PONTOON**, in war, denotes a little floating bridge made of boats and planks.
- PONTUS**, the ancient name of the countries situated on the south side of the Euxine sea, now a part of Asiatic Turkey.
- POOL**, in geography, a borough and port town of Dorsetshire, situated on a bay of the English channel, twenty miles east of Dorchester. It sends two members to parliament.
- POOLWAY**, one of the Banda or nutmeg-islands in the Indian ocean: E. long. 128°, S. lat. 3° 30'.
- POOP**, the stern of a ship, or the highest, uppermost, and hinder part of the ship's hull.
- POOR**, in law, an appellation given to all persons who are in so low and mean a condition, as that they either are, or may become a burden to a parish.
- POPAYAN**, a province of South America, bounded by Terra-Firma, on the north; by New Granada, on the east; by Peru, on the south; and by the pacific ocean, on the west; situated between 75 and 80 degrees west longitude, and between the equator and 5 degrees of north latitude, being four hundred miles long, and about three hundred broad.
- POPE**, the sovereign pontiff, or supreme head of the Romish church. The appellation of pope was anciently given to all Christian bishops; but about the latter end of the eleventh century, in the pontificate of Gregory VII. it was usurped by the bishop of Rome, whose peculiar title it has ever since continued.
- POPE'S TERRITORIES**, in Italy, are bounded by the Venetian territories, on the north; by the gulph of Venice, on the north-east; by Naples, on the south-east; by the Tuscan sea, on the south-west; and by the duchy of Tuscany, on the north-west, almost encompassing that duchy on the land side; being about two hundred and twenty miles long, and from twenty to one hundred and forty in breadth.
- POPE**, in ornithology. See **ALCA**.
- POPLAR**, in botany. See **POPULUS**.
- POPULITÆUS**, in anatomy. See **ANATOMY**, p. 208.
- POPPY**, in botany. See **PAPAVER**.
- POPULAR**, something that relates to the common people.
- POPULUS**, the poplar, in botany, a genus of the diœcia octandria class. The corolla of the male is turbinate, oblique, and entire; the stigma of the female is quadrid; and the capsule has two cells, containing many pappous seeds. There are five species, three of them natives of Britain, *viz.* the alba, or white poplar; the nigra, or black poplar; and the tremula, or trembling poplar, or asp.
- PORCELAIN**, a fine sort of earthen-ware, chiefly manufactured in China, and thence called china-ware. The most just idea we can form of the porcelain, or china-ware,

ware, is, that it is an half vitrified substance, or manufacture, in a middle state between the common baked earthen ware of our vulgar manufactures, and true glass. This is the essential and distinctive character of porcelain; and it is only by considering it in this light, that we are to hope of arriving at the perfect art of imitating it in Europe. This attempt is to be made on these principles in two different manners. The one by finding some appropriated matter, on which fire acts with more than ordinary strength, in the time of its passing from the common baked state of earthen ware into that of glass. The other is to compose a paste of two substances, reduced to a powder; the one of which shall be of force to resist a very violent fire, so as not to become vitrified in it; and the other a matter very easily vitrifiable. In the first case, the matter is to be taken out of the fire at the time when it is imperfectly vitrified; and in the other, the compound mass is to remain in the furnace, till the one substance which is the more easily vitrifiable is truly vitrified; and being then taken out, the whole will be what porcelain is, a substance in part vitrified, but not wholly so. The first method is that by which the European porcelain has been generally made, which though it may be very beautiful, yet it is always easy to distinguish even the finest of it from the china-ware: and the nature of the two substances appears evidently different: these owing all their beauty to their near approach to vitrification, are made to endure a long and violent fire, and are taken from it at a time when a little longer continuance should have made them perfect glass; on the contrary, the china-ware being made of a paste, part of which is made of a substance in itself scarce possible to be vitrified, bears the fire in a yet much more intense degree than ours, and is in no danger of running wholly into glass from it.

The two substances used by the Chinese, are well known by the names of petunse and kaolin; and on examining these, it appears very evident, that we have in Europe the very same substances, or at least substances of the very same nature, capable of being wrought into porcelain equally beautiful and fine.

**PORCELAIN-SHELL.** See *CYPRÆA*.

**PORCUPINE,** in zoology. See *HISTRIX*.

**PORE,** in anatomy, a little interstice or space between the parts of the skin, serving for perspiration.

**PORELLA,** in botany, a genus of mosses, the anthera of which is multilocular and foraminose. See *MOSS*.

**PORIA,** a genus of fungus, growing horizontally; but having its under side not formed into lamellæ, but full of little holes or pores.

There are a great many species of poria, among which is the agaric of the shops. See *AGARIC*, and *STYPTIC*.

**PORPESSE,** in ichthyology. See *DELPHINUS*.

**PORPHYRY,** in natural history, a kind of stone of a plain uniform mass, spotted with separate concretions, of great hardness, giving fire with steel, not fermenting with acids, and very slowly and difficultly calcining in a strong fire.

Porphyry is of several sorts; as, 1. The porphyry of the ancients, which is a most elegant mass of an extremely firm and compact structure, remarkably heavy, and of a fine strong purple, variegated more or less with pale red, and white: its purple is of all degrees, from the cla-

ret-colour to that of the violet; and its variegations are rarely disposed in veins, but spots, sometimes very small, and at others running into large blotches. It is less fine than many of the ordinary marbles; but it excels them all in hardness, and is capable of a most elegant polish. It is still found in immense strata in Egypt. 2. The hard red lead-coloured porphyry, variegated with black, white, green. This is a most beautiful and valuable substance. It has the hardness, and all the other characters of the oriental porphyry; and even greatly excels it in brightness, and in the beauty and variegation of its colours. It is found in great plenty in the island of Minorca; and is extremely worth importing, for it is greatly superior to all the Italian marbles. 3. The hard pale-red porphyry, variegated with black, white, and green. This is of a pale flesh-colour; often approaching to white. It is variegated in blotches from half an inch to an inch broad. It takes a high polish, and emulates all the qualities of the oriental porphyry. It is found in immense strata in Arabia Petræa, and in the Upper Egypt: and in separate nodules in Germany, England, and Ireland.

**PORPHYRY-SHELL.** See *MUREX*.

**PORRUM,** in botany, See *ALLIUM*.

**PORT-GREVE,** or **PORT-GRAVE,** was formerly the principal magistrat of maritime towns. The chief magistrat of London was anciently called by this name, till Richard I. caused the city to be governed by two bailiffs; soon after which king John granted the city a mayor.

**PORT-L'ORIENT,** in geography, a fortress and port-town of Briquy in France, at the mouth of the river Blavet: W. long. 3° 15', N. lat. 47° 42'.

**PORT-LOUIS,** a port-town of Briquy in France, situated in the bay of Biscay: W. long. 3° 6', N. lat. 47° 42'.

**PORT-MAHON,** a port-town of the island of Minorca, situated on a fine bay at the east end of the island, in E. long. 4° 6', N. lat. 39° 50'.

**PORT-ROYAL,** the name of two monasteries of Cistercian nuns, in the diocese of Paris; the one near Chevreuse, at the distance of five leagues from Paris, called Port-Royal of the fields; and the other in Paris, in the suburbs of St James.

The nuns of the former of these monasteries, proving refractory, were dispersed; when many ecclesiastics, and others who were of the same sentiments as these religious, retired to Port Royal, took apartments there, and printed many books: hence the name of Port-Royalists was given to all of their party, and their books were called books of Port-Royal: from hence we say the writers of Port Royal, Messieurs de Port-Royal, and the translations and grammars of Port-Royal.

**PORT-ROYAL,** in geography, a port-town, situated in the extremity of a long point of land, in the south-east part of the island of Jamaica: W. long. 77°, N. lat. 17° 30'.

**PORT-ROYAL,** an island on the coast of South-Carolina, which, with the neighbouring continent, forms one of the most commodious harbours in the British plantations: W. long. 80°, N. lat. 31° 45'.

**PORTA,** or **VENA PORTA,** in anatomy. See *ANATOMY*, p. 244.

**PORTATE,** or a **CROSS PORTATE,** in heraldry, a cross which does not stand upright, as crosses generally do, but lies across the escutcheon in bend, as if it were carried.

carried on a man's shoulders. See Plate CXLV. fig. 2.

**PORTRENTRU**, a city of Switzerland, in the bishoprick of Basle: E. long. 7°, N. lat. 47° 30'.

**PORTER**, a kind of malt-liquor, which differs from ale and pale-beer in its being made with high-dried malt. See **BREWING**.

**PORTICO**, in architecture, a kind of gallery on the ground, supported by columns, where people walk under covert.

**PORTLAND**, a peninsula in Dorsetshire, situated in the English channel, ten miles south of Dorchester, famous for producing the best free-stone.

**PORTO BELLO**, a port-town of America, situated on the narrowest part of the isthmus of Darien: W. long. 82°, N. lat. 10°.

**PORTO-RICO**, an island in the American ocean, one hundred and twenty miles long, and sixty broad, which produces sugar, rum, and ginger: situated between 64° and 68° of W. long. and in 8° of N. lat. It is subject to Spain. The capital is also called Porto Rico, and St John's city.

**PORTO SANTO**, the least of the Madeira islands, eighteen miles in circumference: W. long. 16°, N. lat. 33°.

**PORTRAIT**, in painting, the representation of a person, and especially of a face, done from the life.

In this sense we use the term portrait-painting, in contradistinction to history-painting, where a resemblance of person is usually disregarded. Portraits, when as large as the life, are usually painted in oil-colours; sometimes they are painted in miniature with water-colours, crayons, pastels, &c.

**PORTSMOUTH**, a borough and port town of Hampshire, situated on a fine bay of the English channel; it has one of the most secure, capacious, and best fortified harbours in England: W. long. 1° 6', N. lat. 50° 48'. It sends two members to parliament.

**PORTUGAL**, the most westerly kingdom in Europe: it is about three hundred miles long, and one hundred broad; and is situated between 7° and 10° of W. long. and between 37° and 42° of N. lat. being bounded by Spain on the north and east, and by the Atlantic ocean on the south and west. This country is neither so hot nor so fruitful as Spain; it however produces plenty of grapes, olives, oranges and lemons.

**PORTUGALLICA TERRA**, *earth of Portugal*, the name of a fine astringent bole, dug in great plenty in the northern parts of Portugal, and esteemed a remedy against poisons and venomous bites, and malignant fevers.

**PORTULACA**, in botany, a genus of the dodecandria monogynia class. The corolla consists of five petals, and the calix of two segments. There are six species, none of them natives of Britain.

**POSE**, in heraldry, denotes a lion, horse, or other beast standing still, with all his four feet on the ground.

**POSITIVE**, a term of relation, opposed to negative. It is also used in opposition to relative or arbitrary: thus we say, beauty is no positive thing, but depends on the different tastes of people.

**POSITIVE DEGREE**, in grammar, is the adjective in its simple signification, without any comparison. See **GRAMMAR**.

**POSSE COMITATUS**, in law, signifies the power of the county, or the aid and assistance of all the knights,

gentlemen, yeomen, labourers, servants, apprentices, &c. and all others within the county that are above the age of fifteen, except women, ecclesiastical persons, and such as are decrepit and infirm.

This posse comitatus is to be raised where a riot is committed, a possession kept upon a forcible entry, or any force of rescue used, contrary to the king's writ, or in opposition to the execution of justice; and it is the duty of all sheriffs to assist justices of the peace in the suppression of riots, &c. and to raise the posse comitatus, or to charge any number of men for that purpose.

**POSSESSION**, in Scots law. See **LAW**, Tit. viii. 11.

**POSSESSIVE**, in grammar, a term applied to pronouns which denote the enjoyment or possession of any thing either in particular or in common: as *meus*, mine; and *tuus*, thine.

**POSSESSORY action**, in Scots law. See **LAW**, Tit. xxx. 18.

**POSSIBILITY**, in law, is defined to be any thing that is altogether uncertain, or what may or may not be.

**POSSIBILITY** also denotes a non-repugnance to existing, in any thing that does not any way exist.

**POSSIBLE**, is sometimes opposed to real existence; and is understood of a thing which, though it does not actually exist, yet may exist; as a new star.

**POST**, a courier or letter-carrier, or one who frequently changes horses, posted or placed on the road, for quicker dispatch. The word is also applied to the houses where such a person takes up and lays down his charge.

In England, posts were first established by act of parliament in the twelfth year of the reign of Charles II. which enabled the king to settle a post-office, and appoint a governor.

**Penny Post**, a post established for the benefit of London and the adjacent parts, by which any letter or parcel not exceeding sixteen ounces weight, is speedily conveyed to and from all parts within ten miles of London.

**POSTDAM**, or **POTSDAM**, a town of Germany in the marquisate of Brandenburg, ten miles south-west of Berlin.

**POSTHUMOUS**, a child born after the death of his father, or taken out of the body of a dead mother; from whence it is frequently applied to the works of an author not published till after his decease.

**POSTING**, among merchants, the putting an account forward from one book to another, particularly from the journal or waste-book to the ledger. See **BOOK-KEEPING**.

**POSTLIMINIUM**, among the Romans, the return of one who had gone to sojourn elsewhere, or had been banished or taken by an enemy to his own country and state.

**POSTULATE**, in mathematics, &c. is described to be such an easy and self-evident supposition, as needs no explication or illustration to render it intelligible; as, that a right line may be drawn from one point to another.

**POTAMOGETON**, in botany, a genus of the tetrandria tetragynia class. It has no calix, nor stylus; but has four petals, and four seeds. There are 12 species, 10 of them natives of Britain.

**POTANCE**, in heraldry, a cross like that represented in Plate CXLV. fig. 4.

POT-

**POT-ASH**, the lixivious-ashes of certain vegetables, used in the making of glass, soap, &c.

The method of making pot-ash is directed by Dr Shaw, as follows. Burn a quantity of billet-wood to grey ashes; and taking several pounds of these ashes, boil them in water, so as to make a very strong lixivium, or lye. Let this lye be strained through a coarse linen cloth, to keep out any black parts of the half-burnt wood, that might happen to remain in the ashes: then evaporate this strained lye in an iron-pan over a quick fire almost to dryness: then taking out the matter remaining at the bottom, and putting it into an iron-crucible, set it in a strong fire till the matter is melted, and then immediately pour it out upon an iron-plate, where it soon cools, and appears in the form of a solid lump of pot-ash. Much after this manner is pot-ash made in the large way of business, for the service of the soap-boiler, glass-maker, fuller, &c. but according to the difference of the wood or combustible matter employed, with the manner of turning it, and conducting the process, different kinds of pot-ash are prepared.

**POTATOE**, in botany. See **CONVOLVULUS**, of which it is a species.

**POTENT**, or **POTENCE**, in heraldry, a term for a kind of a cross, whose ends all terminate like the head of a crutch. It is otherwise called the Jerusalem cross, and is represented in Plate CXLV. fig. 5.

**POTENTIA**, **POWER**, that whereby a thing is capable either of acting, or being acted upon.

**POTENTIAL**, in the schools, is used to denote and distinguish a kind of qualities, which are supposed to exist in the body in potentia only, by which they are capable in some manner of affecting and impressing on us the ideas of such qualities, though not actually inherent in themselves; in which sense we say, potential heat, potential cold.

**POTENTIAL**, in medicine. Cauteries are distinguished into actual and potential. See **CAUTERY**.

**POTENTIAL**, in grammar, an epithet applied to one of the moods of verbs. The potential is the same in form with the subjunctive. See **GRAMMAR**.

**POTENTILLA**, in botany, a genus of the icosaandria polygynia class. The calix consists of ten segments, and the corolla of five petals; the seeds are round, naked, and fixed to the receptacle. There are 27 species, 8 of them natives of Britain.

This plant is said to possess in a great measure the virtues of the peruvian bark.

**POTERIUM**, in botany, a genus of the monœcia polyandria class. The calix of the male consists of five segments, that of the female has but one entire rough leaf. Neither of them have any corolla; the stamina of the male are from five to ten; and the styli of the female are from two to five; and the seed is single and oval. There are three species, one of which, *viz.* the sanguiforba, or burnet, is a native of Britain.

**POTHOS**, in botany a genus of the gynœndria polyandria class. The spathe and spadix are roundish; it has no calix; the corolla has four petals; and the berry contains many seeds. There are seven species, none of them natives of Britain.

**POTION**, a liquid medicine, consisting of as much as can be drank at one draught.

**POTOSI**, a city of Peru in South America, situated at the bottom of a mountain of that name, in which is the richest silver-mine ever discovered: W. long. 67°, S. lat. 22°.

**POTTERY**, the manufacture of earthen ware, or the art of making earthen vessels.

The wheel and lathe are the chief, and almost the only instruments used in pottery: the first for large works, and the last for small. The potter's wheel consists principally in the nut; which is a beam or axis, whose foot or pivot plays perpendicularly on the free-stone sole or bottom. From the four corners of this beam, which does not exceed two feet in height, arise four iron-bars, called the spokes of the wheel; which forming diagonal lines with the beam, descend, and are fastened at bottom to the edges of a strong wooden circle, four feet in diameter, perfectly like the felloes of a coach-wheel, except that it has neither axis nor radii, and is only joined to the beam which serves it as an axis by the iron-bars. The top of the nut is flat, of a circular figure, and a foot in diameter; and on this is laid the clay which is to be turned and fashioned. The wheel, thus disposed, is encompassed with four different pieces of wood fastened on a wooden frame. The hind-piece, which is that on which workman sits, is made a little inclining towards the wheel: on the fore-piece are placed the prepared earth: on the side-pieces he rests his feet; and these are made inclining, to give him more or less room. Having prepared the earth, the potter lays a round piece of it on the circular head of the nut; and sitting down turns the wheel with his feet, till it has got the proper velocity; then, wetting his hands with water, he presses his fist or his fingers-ends into the middle of the lump, and thus forms the cavity of the vessel, continuing to widen it from the middle; and thus turning the inside into form with one hand, while he proportions the outside with the other, the wheel constantly turning all the while, and he wetting his hands from time to time. When the vessel is too thick, he uses a flat piece of iron, somewhat sharp on the edge, to pare off what is redundant; and when it is finished, it is taken off from the circular head, by a wire passed underneath the vessel.

The potter's lathe is also a kind of wheel, but more simple and slight than the former. Its three chief members are an iron-beam or axis, three feet and a half high, and two feet and a half diameter, placed horizontally at the top of the beam, and serving to form the vessel upon; and another larger wooden wheel, all of a piece, three inches thick, and two or three feet broad, fastened to the same beam at the bottom, and parallel to the horizon. The beam or axis turns by a pivot at the bottom in an iron-stand. The workman gives the motion to the lathe with his feet, by pushing the great wheel alternately with each foot, still giving it a greater or lesser degree of motion, as his work requires. They work with the lathe, with the same instruments, and after the same manner as with the wheel. The mouldings are formed by holding a piece of wood or iron cut in the form of the moulding to the vessel, while the wheel is turning round; but the feet and handles are made by themselves, and set on with the hand; and if there be any sculpture in the work, it is usually done in wooden moulds, and stuck on piece by piece on the outside of the vessel.

**POTTLE**, an English measure containing two quarts.

**POULTRY**,

**POULTRY**, all kinds of domestic birds brought up in yards, as cocks, hens, capons, ducks, turkeys, &c.

**POUND**, a standing weight. See **MONEY**.

**POUND** also denotes a money of account; so called, because the ancient pound of silver weighed a pound troy. See **MONEY**.

**POUNDAGE**, a subsidy of 12 d. in the pound granted to the crown on all goods and merchandizes exported or imported; and if by aliens, one penny more.

**POURPRESTURE**, in law, is a wrongful inclosure, or encroachment upon another person's property.

**POURSUIVANT**, or **PURSUIVANT**, in heraldry, the lowest order of officers at arms.

The poursuivants are properly attendants on the heralds, when they marshal public ceremonies. Of these in England, there were formerly many, but at present there are only four, *viz.* blue-mantle, rouge-crois, rouge-dragon, and portuculice. In Scotland, there is only one king at arms, who is styled **Lion**; and has no less than six heralds, and as many pursuivants, and a great many messengers at arms, under him.

**POURVEYANCE**, or **PURVEYANCE**, in law, the providing corn, fuel, victual, &c. for the king's household; and hence the officer who did so was termed *pourveyor*.

**POWDER**, in pharmacy, a dry medicine well broken, either in a mortar by grinding or by chemical operations.

**POWER**, the faculty of doing or suffering any thing.

Power therefore is two-fold *viz.* considered as able to make, or able to receive any change; the former whereof may be called active power, and the latter passive power. See **METAPHYSICS**.

**POWER**, in mechanics. See **MECHANICS**.

**POWER**, in law, signifies, in general, a particular authority granted by any person to another to represent him, or act in his stead.

**POWERS**, in arithmetic and algebra, are nothing but the products arising from the continual multiplications of a number, or quantity, into itself. See **ALGEBRA**, p. 81. and **ARITHMETIC**, p. 420.

**POX**, or **SMALL POX**, in medicine. See **MEDICINE**, p. 75. *French Pox*. See **MEDICINE**, p. 133.

**PRACTICE**, in arithmetic. See **ARITHMETIC**, p. 393.

**PRAGMATIC SANCTION**, in the civil law, is defined by Hottoman to be a rescript, or answer of the sovereign, delivered by advice of his council, to some college, order, or body of people, upon consulting him on some case of their community. The like answer given to any particular person, is called simply rescript. The term pragmatic sanction, is chiefly applied to a settlement of Charles VI. emperor of Germany, who, in the year 1722, having no sons, settled his hereditary dominions on his eldest daughter, the archduchess Maria Theresa which was confirmed by the diet of the empire, and guaranteed by Great Britain, France, the States general, and most of the powers in Europe.

**PRÆCEPTIO HEREDITATIS**, in Scots law. See **LAW**, Tit. xxvii. 33.

**PRAGUE**, the capital of Bohemia, situated on the river Mulda, in E. long. 14° 20', N lat. 50°. This is a strong fine city; and next to London, Paris, and Constantinople, the largest in Europe.

**PRAMNION**, in natural history, the name of a semi-pellucid gem.

This is a very singular stone, and of a very great cen-

cealed beauty: our lapidaries, when they meet with it, call it by the name of the black agate. It is of an extremely close, compact, and firm texture, of a smooth and equal surface, and in shape very irregular, being sometimes round, sometimes oblong, and often flat; in size it seldom exceeds two inches. It appears, on a common inspection, to be of a fine deep black; but held up against the sun, or the light of a candle, it is an elegant red, clouded by a quantity of subtile black earth. We have it from the East-Indies,

**PRASIUM**, in botany, a genus of the didymia gymnospermia class. The berries are four, each containing one seed. There are two species, none of them natives of Britain.

**PRATIQUE**, or **PRATIC**, in commerce, a negotiation, or communication, of commerce, which a merchant vessel obtains in the port it arrives in, and the countries it discovers; hence to obtain a pratique, is to obtain a liberty to frequent a port, to go ashore, to buy and sell, &c.

**PREAMBLE**, in law, the beginning of an act of parliament, &c. which serves to open the intent of the act, and the mischiefs intended to be remedied by it.

**PREBEND**, the maintenance a prebendary receives out of the estate of a cathedral or collegiate church.

**PREBENDARY**, any ecclesiastic who enjoys a prebend.

**PRECARIUM**, in Scots law. See **LAW**, Tit. xx. 9.

**PRECEDENCE**, a place of honour to which a person is entitled. This is either of courtesy or of right. The former is that which is due to age, estate, &c. which is regulated by custom and civility; the latter is settled by authority, and, when broken upon, gives an action at law.

**PRECEDENT**, in law, a case which has been determined, and which serves as a rule for all of the same nature.

**PRECEPT**, in law, a command in writing sent by a chief justice, justice of the peace, &c. for bringing a person, record, or other matter, before him.

**PRECEPT OF CLARE CONSTAT**, in Scots law. See **LAW**, Tit. xxvii. 28.

**PRECEPT OF SEISIN**, in Scots law. See **LAW**, Tit. x. 15.

**PRECESSION**, in astronomy. See **ASTRONOMY**, p. 562.

**PRECIPITANT**, in chemistry, is applied to any liquor, which, when poured on a solution, separates what is dissolved, and makes it precipitate, or fall to the bottom of the vessel. See **CHEMISTRY**.

The term precipitant is also used, in medicine, to denote any remedy that moderates the heat of the blood, by separating; as is supposed, any heterogeneous matter contained therein.

**PRECIPITATE**, in chemistry, a substance which, having been dissolved in a proper menstrum, is again separated from its solvent, and thrown down to the bottom of the vessel by pouring some other liquor upon it.

**PRECIPITATION**. See **CHEMISTRY**, p. 69, 107.

**PRECOGNITION**, in Scots law. See **LAW**, Tit. xxxiii.

**PRECORDIA**, in anatomy, a general name for the parts situated about the heart, in the fore-part of the thorax; as the diaphragm, pericardium, and even the heart itself, with the spleen, lungs, &c. See **ANATOMY**.

**PREDECESSOR**, properly signifies a person who has preceded or gone before another in the same office or employment; in which sense, it is distinguished from ancestor.

**PREDESTINATION**, in general, signifies a decree of God, whereby, from all eternity, he ordained such a concatenation of causes as must produce every event by a kind of necessity.

In this sense, the Turks are great predestinarians; and on this account are much more daring in battle, and will hardly encounter greater dangers than they would otherwise do. See **MAHOMETANISM**.

Predestination, among Christians, is used, in a more limited sense, for a judgment or decree of God, whereby he has resolved, from all eternity, to save a certain number of persons, from thence called elect; so that the rest of mankind being left in a state of impenitence, are said to be reprobated.

**PREDICABLE** among logicians, denotes a general quality which may be predicated or asserted of several things: thus animal is predicable of mankind, beasts, birds, fishes, &c. See **LOGIC**.

**PREDICAMENT**, among logicians. See **LOGIC**.

**PREDICATE**, in logic, that part of a proposition which affirms or denies something of the subject. See **LOGIC**.

**PREENING**, in natural history, the action of birds dressing their feathers, to enable them to glide the more readily through the air, &c.

For this purpose they have two peculiar glands on their rump, which secrete an unctuous matter into a bag that is perforated, out of which the bird occasionally draws it with its bill.

**PRE-EXISTENCE**, the state of a thing actually in being before another.

**PREFACE**, something introductory to a book, to inform the reader of the design, method, &c. observed therein, and generally whatever is necessary to facilitate the understanding of a book.

**PREFECT**, in ancient Rome, one of the chief magistrates who governed in the absence of the kings, consuls, and emperors.

**PREFECT of the pretorium**, the leader of the pretorian bands destined for the emperor's guards, consisting, according to Dion, of 10,000 men. This officer, according to Suetonius, was instituted by Augustus, and usually taken from among the knights.

**PREGNANCY**, the state of a woman who has conceived, or is with child. See **MIDWIFERY**.

**PREJUDICE** does not mean a judgment merely as prior to another in respect of time, but as being passed before the things were duly considered and fully understood. Hence prejudice is sometimes called anticipation, and a preconceived opinion.

**PRELATE**, an ecclesiastic raised to some eminent and superior dignity in the church; as bishops, archbishops, patriarchs, &c.

**PRELIMINARY**, in general, denotes something to be examined and determined, before an affair can be treated of to the purpose.

**PRELUDE**, in music, is usually a flourish or irregular air, which a musician plays off-hand, to try if his instrument be in tune, and so lead him into the piece to be played.

**PREMISSES**, in logic, an appellation given to the two first propositions of a syllogism. See **LOGIC**.

**PRENANTHES**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; and the pappus is simple. There are seven species, only one

of them, viz. the muralis, or ivy-leaved wild lettuce, is a native of Britain.

**PREPOSITA NEGOTIIS DOMESTICIS**, in Scots law. See **LAW**, Tit. vi. 18.

**PREPOSITION**, in grammar. See **GRAMMAR**.

**PREPUCE**, in anatomy. See **ANATOMY**, p. 274.

**PREROGATIVE of the king**, that power which the king hath, not only over other persons, but over the ordinary course of the common law, in right of his crown.

Such as, that he may pardon a person condemned to die, that the king's person is subject to no man's suit, his possessions cannot be taken from him by any violence, his goods are subject to no tribute, nor distrainable, &c.

**PRESAGE**, in antiquity, denotes an augury, or sign of some future event; which was chiefly taken from the flight of birds, the entrails of victims, &c. See **AUGURY**, and **ARUSPICES**.

**PRESBURG**, the capital of Hungary, a large city on the north side of the Danube. fifty miles east of Vienna: E. long. 17° 30', N lat. 49° 20'.

**PRESBYTA**, in optics, a person whose eyes being flat, can see distant objects distinctly, but those near confusedly; which defect of sight got this appellation, because old people are naturally subject to it.

Spectacles, or convex glasses, are the only remedy for this defect.

**PRESBYTER**, in the primitive Christian church, an elder, and of the second order of ecclesiastics; the other two being bishops and deacons.

**PRESBYTERIANS**, protestants, so called from their maintaining that the government of the church appointed in the New Testament was by presbyteries; that is, by ministers and ruling elders, associated for its government and discipline.

The presbyterians affirm, that there is no order in the church as established by Christ and his apostles superior to that of presbyters; that all ministers, being ambassadors of Christ, are equal by their commission; and that elder or presbyter, and bishop, are the same in name and office: for which they alledge, *Acts* xx. 28, &c.

The only difference between them and the church of England, relates to discipline and church-government. Their highest assembly is a synod, which may be provincial, national, or œcumenical; and they allow of appeals from inferior to superior assemblies; according to *Acts* xv. 2, 6, 22, 23. The next assembly is composed of a number of ministers and elders, associated for governing the churches within certain bounds. This authority they found upon *Acts* xi. 30. *Acts* xv. 4, 6, &c. The lowest of their assemblies or presbyteries consists of the minister and elders of a congregation, who have power to cite before them any member, and to admonish, instruct, rebuke, and suspend him from the eucharist. They have also a deacon, whose office is to take care of the poor.

The ordination of their ministers is by prayer, fasting, and imposition of the hands of the presbytery. This is now the discipline of the church of Scotland.

**PRESCIENCE**, in theology, fore knowledge, or the knowledge which God has of events before they come to pass.

**PRESCRIPTION**, in Scots law. See **LAW**, Tit. xxvi. 1.

**PRESENCE**, a term of relation used in opposition to absence, and signifying the existence of a person in a certain place.

**PRESENT TENSE**, in grammar. See **GRAMMAR**.

PRESENTATION, in Scots law. See *LAW*, Tit. v. 7.

PRESS, in the mechanic arts, a machine of wood, or iron, serving to squeeze any body very close, generally by means of a screw. See *MECHANICS*.

PRESTER JOHN, or JEAN, an appellation given to the king of Abyssinia or Ethiopia.

This name is altogether unknown in Ethiopia, where he is called the grand Negus.

PRESTO, in the Italian musick, intimates to perform very quick, as *prestissimo* does extremely so.

PRESTON, a borough-town, twenty miles south of Lancaster, which sends two members to parliament.

PRESUMPTION, in Scots law. See *LAW*, Tit. xxxi. 18.

PRETERITE TENSE, in grammar. See *GRAMMAR*.

PRETEXT, a colour or motive, whether real or feigned, for doing something.

Toga PRETEXTA, among the ancient Romans, a long white gown, with a border of purple round the edges, and worn by children of quality till the age of puberty, viz. by the boys till seventeen, when they changed it for the toga virilis; and by the girls till marriage.

PRETOR, a magistrate among the ancient Romans, not unlike our lord chief justices, or lord chancellor, or both in one: as being vested with the power of distributing justice among the citizens. At first there was only one pretor; but afterwards another being created, the first or chief one had the title of pretor urbanus, or the city-pretor; the other was called peregrinus, as being judge in all matters relating to foreigners. But, besides these, there were afterwards created many provincial pretors; who were not only judges, but also assisted the consuls in the government of the provinces, and even were invested with the government of provinces themselves.

PRETORIAN GUARDS, in Roman antiquity, were the emperor's guards, who at length were increased to ten thousand: they had this denomination, according to some, from their being stationed at a place in the palace called prætorium: their commander was stiled præfectus prætorii. See *PREFECT*.

PRETORIUM, among the Romans, denoted the hall or court wherein the pretor lived, and wherein he administered justice.

PREVENTION in Jurisdiction, in Scots law. See *LAW*, Tit. ii. 5.

PRIAPISM, in medicine, a continual and painful erection of the penis.

PRIAPUS, in medicine, denotes the genital parts in men. It also denotes in antiquity, a fabulous deity, particularly adored at Lampsacus, the place of his birth, who was revered very much for the extraordinary size of his parts.

PRIEST, a person set apart for the performing of sacrifice and other offices of religion.

PRIEST, in the Christian church, is a person invested with holy orders: in virtue whereof he has a power to preach, pray, administer the sacraments, &c.

PRIME VIEÆ, among physicians, denote the whole alimentary duct; including the œsophagus, stomach, and intestines, with their appendages.

PRIMAGE, in commerce, a small duty at the water side, usually about twelve pence per tun, or six pence a bale, due to the master and mariners of a ship.

PRIMATE, in church polity, an archbishop, who is invested with a jurisdiction over other bishops.

PRIME, an appellation given to whatever is first in order, degree, or dignity, among several things of the same or like kind; thus we say the prime minister, prime coat, &c.

PRIMIPILUS, in antiquity, the centurion of the first cohort of a legion, who had charge of the Roman eagle.

PRIMITIÆ, the first fruits gathered of the earth, whereof the ancients made presents to the gods.

PRIMITIVE, in grammar, is a root or original word in a language, in contradistinction to derivative: thus, *God* is a primitive, *godly* a derivative, and *god-like* a compound.

PRIMULA, in botany, a genus of the pentandria monogynia class. The tube of the corolla is cylindrical, with an open mouth. There are eight species, three of them natives of Britain, viz. the vulgaris, or common primrose; the veris, or cows-lips; and the farinosa, or birds-eye.

PRINCE, in polity, a person invested with the supreme command of a state, independent of any other.

Prince also denotes a person who is a sovereign in his own territories, yet holds of some other as his superior; such are the princes of Germany.

PRINCIPAL, the chief and most necessary part of a thing.

PRINCIPATE, a province of the kingdom of Naples, situated on the Mediterranean, between the provinces of Lavoro and Calabria; and divided into the Hither and Further Principate, with respect to the city of Naples.

PRINCIPLE, in general, is used for the cause, source, or origin of any thing.

PRINCIPLE, is also sometimes used in a synonymous sense with axiom or maxim.

PRINOS, in botany, a genus of the hexandria monogynia class. The calix consists of six segments, and the corolla of one rotated petal; and the berry contains six seeds. There are two species, both natives of America.

PRINT, the impression taken, from a copperplate. See *Rolling-press* PRINTING.

PRINTER, a person who composes and takes impressions from moveable characters ranged in order, or front plates engraven, by means of ink, and a press; or from blocks of wood cut in flowers, &c. and taken off in various colours on calicoes, linens, silks, &c.

The most curious of these arts; and that which deserves the most particular explication, is the first; for to the printers of books are chiefly owing our deliverance from ignorance and error, the progress of learning, the revival of the sciences, and numberless improvements in arts, which, without this noble invention, would have been either lost to mankind, or confined to the knowledge of a few. The first printers were Guttenberg, Faust, Schœffer, Mentel, and Koster; and the first who practised this art in England was Fred. Corseilles, who brought it over from Haerlem, in the reign of king Henry VI. The great printers famous for the correctness and elegance of their works, were Aldus, and Paulus Manutius; the two Badii; William and Frederic Morel; Oporin; Frobenius; Robert, Henry, and Charles Stephens; Gryphius, Turnebus, Torres, Commelin, Plantin, Raphelengius, Vascofan, Bleau, Crispin, and the two Elzevirs; and among these, the learned printers were the Manutii, the Stephenses, the Bodji, Turnebus, Morel, &c. Plantin had the title of archtypographus, or arch-printer, given him.

him by the king of Spain in consideration of his printing the polyglot of Antwerp. The printers of Germany, &c. generally cast their own letter, and sell their own books. There are in many places ranked among the members of universities, and entitled to the privilege of students. In England, they are esteemed a part of the company of stationers and booksellers.

**PRINTING**, the art of taking impressions from characters or figures, moveable or immovable, on paper, linen, silk, &c. There are three kinds of printing; the one from moveable letters, for books; another from copper-plates, for pictures; and the last from blocks, in which the representation of birds, flowers, &c. are cut, for printing calicoes, linens, &c. the first called common-press printing, the second rolling-press printing, and the last calico, &c. printing. The principal difference between the three consists in this, that the first is cast in relievo, in distinct pieces; the second engraven in creux; and the third cut in relievo, and generally stamped, by placing the block upon the materials to be printed, and striking upon the back of it.

**Progress of PRINTING.** Who the first inventors of the European method of printing books were, in what city and what year it was set on foot, are questions long disputed among the learned. In effect, as the Grecian cities contended for the birth of Homer, so do the German cities for that of printing. Mentz, Haerlem, and Strasburg, are the warmest on this point of honour. John Guttemburg, and John Fust of Mentz; John Mentel of Strasburg, and L. John Koster of Haerlem; are the persons to whom this honour is severally ascribed, by their respective countrymen; and they have all their advocates among the learned. However, their first essays were made on wooden blocks, after the Chinese manner. The book at Haerlem, the vocabulary called *Catholicon*, and the pieces in the Bodleian library, and that of Bennet-college, are all performed in this way; and the impression appears to have been only given on one side of the leaves, after which the two blank sides were pasted together. But they soon found the inconveniences of this method; and therefore bethought themselves of an improvement; which was by making single letters distinct from one another; and these being first done in wood, gave room for a second improvement, which was the making them of metal; and, in order to that, forming moulds, matrices, &c. for casting them.

From this ingenious contrivance we ought to date the origin of the present art of printing, contradistinguished from the method practised by the Chinese. And of this Schoeffer, or Scheffer, first servant, and afterwards partner and son-in-law of Fust, at Mentz, abovementioned, is pretty generally allowed to be the inventor, so that he may properly be reckoned the first printer, and the Bible which was printed with moveable letters in 1450. the first printed book; the next was *Augustine de civitate Dei*, then Tully's offices, printed about the year 1461. In these books they left the places of the initial letters blank, and gave them to the illuminers to have them ornamented and painted in gold and azure, in order to render the work more beautiful, and, as some think, to make their books pass for manuscripts.

Some authors tell us, that Fust carrying a parcel of bibles with him to Paris, and offering them to sale as

manuscripts; the French, upon considering the number of books, and their exact conformity to each other even to a point, and that it was impossible for the best book-writers to be so exact, concluded there was witchcraft in the case, and, by their actually indicting him as a conjurer, or threatening to do so, extorted from him the secret; and hence the origin of the popular story of Dr Faustus.

From Mentz, the art of printing soon spread itself throughout a good part of Europe: Haerlem and Strasburg had it very early; which, as the current of authors represent it, occasioned their pretending to the honour of the invention. From Haerlem it passed to Rome in 1467; and into England in 1468, by means of Tho. Bouchier, archbishop of Canterbury, who sent W. Turner master of the robes, and W. Caxton merchant, to Haerlem to learn the art. These privately prevailing with Corseilles, an under-workman, to come over, a press was set up at Oxford and an edition of Rufinus on the creed was printed the same year in octavo. From Oxford, Caxton brought it to London about the year 1470, and the same year it was carried to Paris. Hitherto there had been nothing printed but in Latin, and the vulgar tongues; and this first in Roman characters, then in Gothic, and at last in Italic: but in 1480, the Italians cast a set of Greek types; and they have also the honour of the first Hebrew editions, which were printed about the same time with the Greek. Towards the end of the sixteenth century there appeared various editions of books in Syriac, Arabic, Persian, Armenian, Coptic or Egyptian characters. Some to gratify the curiosity of the learned, and others for the use of the Christians of the Levant. Out of Europe, the art of printing has been carried into the three other parts of the world: for Asia, we see impressions of books at Goa, and in the Philippines; at Morocco, for Africa; and at Mexico, Lima, Philadelphia, New York, Boston, &c. for America. The Turks indeed, rigorously prohibit printing throughout their empire, as imagining that the too frequent communication with books might occasion some change in their religion and government; yet the Jews have several editions of their books printed at Thessalonica, and even at Constantinople.

**Method of PRINTING.** The workmen employed in the art of printing are of two kinds: compositors, who range and dispose the letters into words, lines, pages, &c. according to the copy delivered them by the author; and pressmen, who apply ink upon the same, and take off the impression. The types being cast, the compositor distributes each kind by itself among the divisions of two wooden frames, an upper and an under one, called cases; each of which is divided into little cells or boxes. Those of the upper case are in number ninety-eight: these are all of the same size; and in them are disposed the capitals, small capitals, accented letters, figures, &c. the capitals being placed in alphabetical order. In the cells of the lower case, which are fifty-four, are placed the small letters, with the points, spaces, &c. The boxes are here of different sizes, the largest being for the letters most used; and these boxes are not in alphabetical order, but the cells which contain the letter oftenset wanted are nearest the compositor's hand. Each case is placed a little aslope, that the compositor may the more easily reach the upper boxes. The instrument in which the letter are set is called a composing-slick, (*ibid.* n<sup>o</sup> 2) which consists

consists of a long and narrow plate of brass, or iron, &c. *cc*; on the right-side of which arises a ledge *bb*, which runs the whole length of the plate, and serves to sustain the letters, the sides of which are to rest against it: a-long this ledge is a row of holes, which serve for introducing the screw *f*; in order to lengthen or shorten the extent of the line, by moving the sliders *e d* farther from or nearer to the shorter ledge at the end *a*. Where marginal notes are required in a work, the two sliding-pieces *e d* are opened to a proper distance from each other, in such a manner as that while the distance between *d* and *c* forms the length of the line in the text, the distance between the two sliding-pieces forms the length of the lines for the notes on the side of the page. Before the compositor proceeds to compose, he puts a rule, or thin slip of brass-plate, cut to the length of the line, and of the same height as the letter, in the composing-stick, against the ledge, for the letter to bear against. Things thus prepared, the compositor having the copy lying before him, and his stick in his left-hand, his thumb being over the slider *d*; with the right, he takes up the letters, spaces, &c. one by one, and places them against the rule, while he supports them with his left thumb by pressing them to the end of the slider *d*, the other hand being constantly employed in setting in other letters: the whole being performed with a degree of expedition and address not easy to be imagined.

A little being thus composed, if it end with a word or syllable, and exactly fill the measure, there needs no further care; otherwise, more spaces are to be put in, or else the distances lessened between the several words, in order to make the measure quite full, so that every line may end even. The spaces here used are pieces of metal exactly shaped like the shanks of the letters: these are of various thicknesses, and serve to support the letters, and to preserve a proper distance between the words; but not reaching so high as the letters, they make no impression when the work is printed. The first line being thus finished, the compositor proceeds to the next; in order to which he moves the brass-rule from behind the former, and places it before it, and thus composes another line against it after the same manner as before; going on thus till his stick is full, when he empties all the lines contained in it into the gally.

The compositor then fills and empties his composing-stick as before, till a complete page be formed; when he ties it up with a cord or pack-thread, and setting it by, proceeds to the next, till the number of pages to be contained in a sheet is completed; which done, he carries them to the imposing-stone, there to be ranged in order, and fastened together in a frame called a chase, and this is termed imposing. The chase is a rectangular iron-frame, of different dimensions, according to the size of the paper to be printed, having two cross-pieces of the same metal, called a long and short cross, mortised at each end so as to be taken out occasionally. By the different situation of these crosses the chase is fitted for different volumes: for quartos and octavos, one traverses the middle lengthwise, the other broadwise, so as to intersect each other in the centre; for twelves and twenty-fours, the short cross is shifted nearer to one end of the chase: for folios, the long cross is left entirely out, and the short one left in the middle; and for broad-sides, both crosses are let

aside. To dress the chase, or range and fix the pages therein, the compositor makes use of a set of furniture, consisting of slips of wood of different dimensions, and about half an inch high, that they may be lower than the letters: some of these are placed at the top of the pages, and called head-sticks; others between them, to form the inner margin; others on the sides of the crosses, to form the outer margin, where the paper is to be doubled; and others in the form of wedges to the sides and bottom of the pages. Thus all the pages being placed at their proper distances, and secured from being injured by the chase and furniture placed about them, they are all untied, and fastened together by driving small pieces of wood called quoins, cut in the wedge-form, up between the slanting side of the foot and side sticks and the chase, by means of a piece of hard wood and a mallet; and all being thus bound fast together, so that none of the letters will fall out, it is ready to be committed to the the pressman. In this condition the work is called a form; and as there are two of these forms required for every sheet, when both sides are to be printed, it is necessary the distances between the pages in each form should be placed with such exactness, that the impression of the pages in one form shall fall exactly on the back of the pages of the other, which is called register.

As it is impossible but that there must be some mistakes in the work, either through the oversight of the compositor, or by the casual transposition of letters in the cases; a sheet is printed off, which is called a proof, and given to the corrector; who reading it over, and rectifying it by the copy, by making the alterations in the margin, it is delivered back to the compositor to be corrected.

The compositor then unlocking the form upon the correcting-stone, by loosening the quoins or wedges which bound the letters together, rectifies the mistakes by picking out the faulty or wrong letters with a slender sharp-pointed steel-bodkin, and puts others into their places. After this another proof is made, sent to the author, and corrected as before; and lastly, there is another proof, called a revise, which is made in order to see whether all the mistakes marked in the last proof are corrected.

The pressman's business is to work off the forms thus prepared and corrected by the compositor; in doing which there are four things required; paper, ink, balls, and a press. To prepare the paper for use, it is to be first wetted by dipping several sheets together in water: these are afterwards laid in a heap over each other; and to make them take the water equally, they are all pressed close down with a weight at the top. The ink is made of oil and lamp-black; for the manner of preparing which, see *Printing Ink*. The balls, by which the ink is applied on the forms, are a kind of wooden funnels with handles, the cavities of which are filled with wool or hair, as is also a piece of alum-leather or pelt nailed over the cavity, and made extremely soft by soaking in urine, and by being well rubbed. One of these the pressman takes in each hand; and applying one of them to the ink-block, daubs and works them together to distribute the ink equally and then blackens the form which is placed on the press, by beating with the balls upon the face of the letter.

The printing-press represented in Plate CXLVII. fig. 1. n<sup>o</sup> 1.

n<sup>o</sup> 1. is a very curious, though complex machine. The body consists of two strong cheeks, *aa*, placed perpendicularly, and joined together by four cross-pieces; the cap *b*; the head *c*, which is moveable, being partly sustained by two iron-pins, or long bolts, that pass the cap; the shelves *dd*, which serve to keep steady a part called the hose; and the winter *e*, which bears the carriage, and sustains the effort of the press beneath. The spindle *f* is an upright piece of iron pointed with steel, having a male-screw which goes into the female one in the head about four inches. Through the eye *g* of this spindle is fastened the bar *k*, by which the pressman makes the impression. Part of the spindle is inclosed in a square wooden frame called the hose *h*, and its point works into a brass-pan supplied with oil, which is fixed to an iron plate let into the top of the platten. At each corner of the hose, there is an iron-hook fastened with pack-thread to those at each end of the platten *i*, in such a manner as to keep it perfectly level. The carriage *ll* is placed a foot below the platten, having its fore-part supported by a prop called the fore-stay, while the other rests on the winter. On this carriage, which sustains the plank, are nailed two long iron-bars or ribs, and on the plank are nailed short pieces of iron or steel called cramp-irons, equally tempered with the ribs, and which slide upon them when the plank is turned in or out. Under the carriage is fixed a long piece of iron called the spit, with a double wheel in the middle, round which leather-girths are fastened, nailed to each end of the plank; and to the outside of the spit is fixed a rounce *m*, or handle to turn round the wheel. Upon the plank is a square frame or coffin, in which is inclosed a polished stone on which the form *n* is laid; at the end of the coffin are three frames, *viz.* the two tympan and frisket: the tympan *o* are square, and made of three slips of very thin wood, and at the top a piece of iron still thinner; that called the outer tympan is fastened with hinges to the coffin: they are both covered with parchment; and between the two are placed blankets, which are necessary to take off the impression of the letters upon the paper. The frisket *p* is a square frame of thin iron, fastened with hinges to the tympan; it is covered with paper cut in the necessary places, that the sheet, which is put between the frisket and the great or outward tympan, may receive the ink, and that nothing may hurt the margins. To regulate the margins, a sheet of paper is fastened upon this tympan, which is called the tympan-sheet; and on each side is fixed an iron point, which makes two holes in the sheet, which is to be placed on the same points, when the impression is to be made on the other side. In preparing the press for working, the parchment which covers the outer tympan is wetted till it is very soft, in order to render the impression more equable; the blankets are then put in, and secured from slipping by the inner tympan: then while one pressman is beating the letter with the balls *q*, covered with ink taken from the ink-block, the other person places a sheet of white paper on the tympan-sheet, turns down the frisket upon it to keep the paper clean and prevent its slipping; then bringing the tympan upon the form, and turning the rounce, he brings the form with the stone, &c. weighing about 300 pounds weight, under the platten; pulls with the bar, by which means the platten presses the blankets and

paper close upon the letter, whereby half the form is printed; then easing the bar, he draws the form still forward, gives a second pull; and letting go the bar, turns back the form, takes up the tympan and frisket, takes out the printed sheet, and lays on a fresh one; and this is repeated till he has taken off the impression upon the full number of sheets the edition is to consist of. One side of the sheet being thus printed, the form for the other is laid upon the press, and worked off in the same manner.

*Chinese* PRINTING, is performed from wooden planks or blocks, cut like those used in printing of callico, paper, cards &c.

*Rolling press* PRINTING, is employed in taking off prints or impressions from copper-plates engraven, etched, or scraped as in mezzotint. See ENGRAVING.

This art is said to have been as ancient as the year 1540. and to owe its origin to Finiguerra, a Florentine goldsmith, who pouring some melted brimstone on an engraven plate, found the exact impression of the engraving left in the cold brimstone, marked with black taken out of the strokes by the liquid sulphur: upon this he attempted to do the same on silver-plates with wet paper, by rolling it smoothly with a roller; and this succeeded: but this art was not used in England till the reign of king James I when it was brought from Antwerp by Speed. The form of the rolling-press, the composition of the ink used therein, and the manner of applying both in taking off prints, are as follow.

The rolling-press AL (Plate CXLVII. fig. 2) may be divided into two parts, the body and carriage: the body consists of two wooden cheeks PP placed perpendicularly on a stand or foot LM, which sustains the whole press. From the foot likewise are four other perpendicular pieces *c, c, c, c*, joined by other cross or horizontal ones *d, d, d*, which serve to sustain a smooth even plank or table HIK, about four feet and a half long, two feet and a half broad, and an inch and a half thick. Into the cheeks go two wooden cylinders or rollers, DE, FG, about six inches in diameter, borne up at each end by the cheeks, whose ends, which are lessened to about two inches diameter, and called trunnions, turn in the cheeks about two pieces of wood in form of half-moons, lined with polished iron to facilitate the motion. Lastly, to one of the trunnions of the upper roller is fastened a cross, consisting of two levers A, B, or pieces of wood, traversing each other, the arms of which cross serve instead of the bar or handle of the letter-press, by turning the upper roller, and when the plank is between the two rollers, giving the same motion to the under one, by drawing the plank forward and backward.

The ink used for copper-plates, is a composition made of the stones of peaches and apricots, the bones of sheep, and ivory, all well burnt, and called Frankfort black, mixt with nut-oil that has been well boiled, and ground together on a marble, after the same manner as painters do their colours.

The method of printing from copper-plates is as follows. They take a small quantity of this ink on a rubber made of linen-rags, strongly bound about each other, and therewith smear the whole face of the plate as it lies on a grate over a charcoal-fire. The plate being sufficient, inked, they first wipe it over with a foul rag, then with

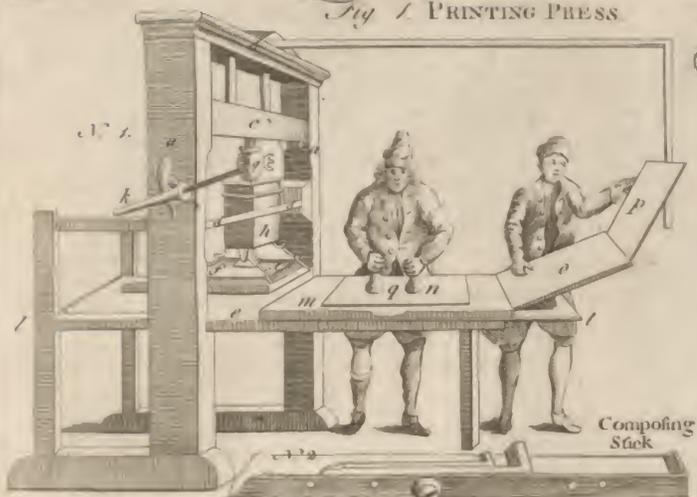


Fig. 2. ROLLING PRESS.



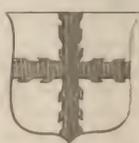
Fig. 3. PURPURE.



1. QUARTERING.



5. RAGULED.



2. RAMPANT.



7. RAYONANT.



8. REMPLY.



9. RESARCELEZ.



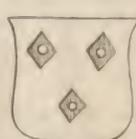
10. RIBBAN.



11. ROMBEE.



12. RUSTRE.



13. SABLE.



14. SALIANT.



15. SALTIER.



16. SCARP.



17. SURMOUNTED.



18. TENNE.



19. TRAVERSE.



20. TRESSURE.



21. VAIR.



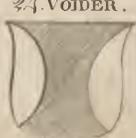
22. VARY CUPPY.

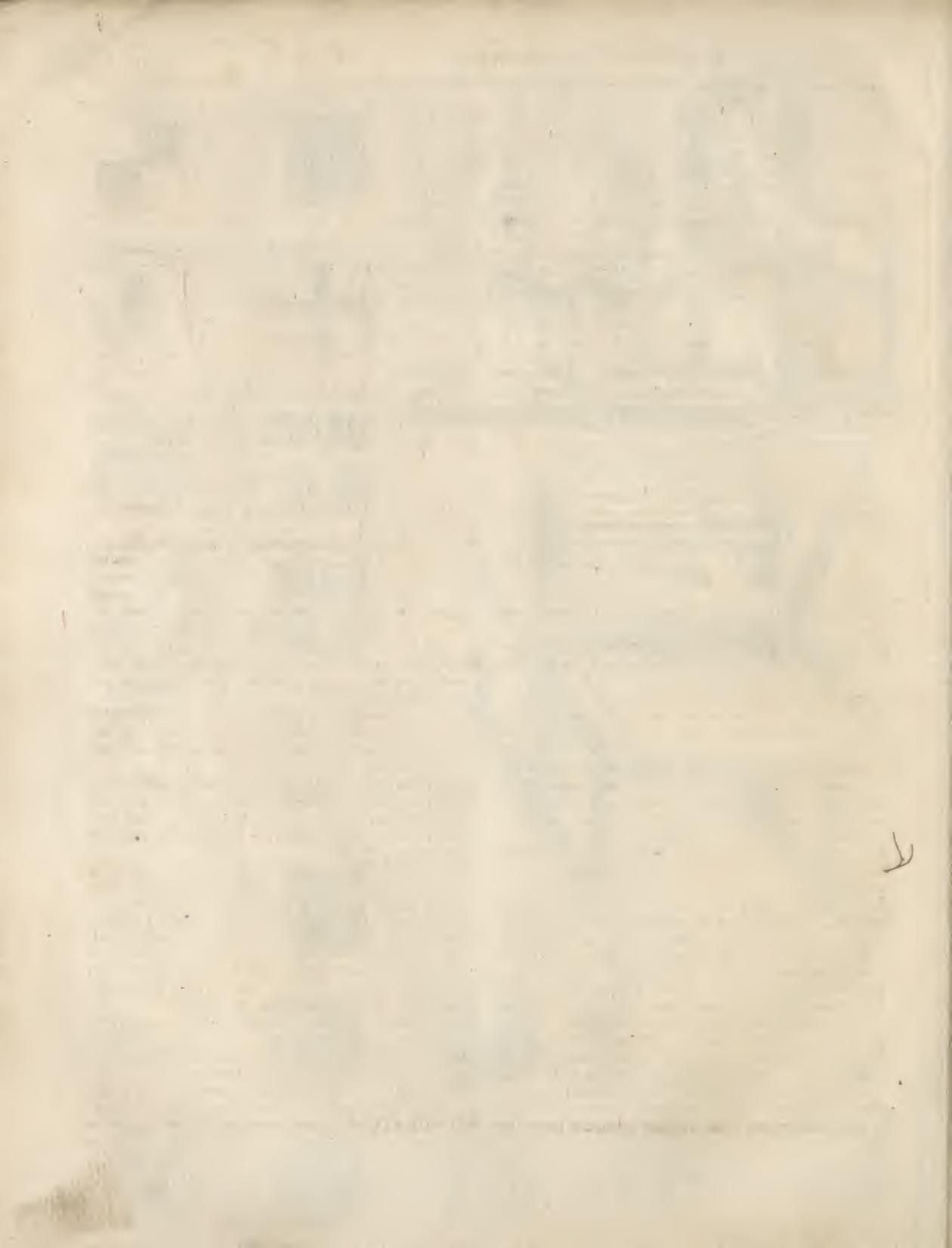


23. VERT.



24. VOIDER.





the palm of their left hand, and then with that of the right; and to dry the hand and forward the wiping, they rub it from time to time in whiting. In wiping the plate perfectly clean, yet without taking the ink out of the engraving, the address of the workman consists. The plate thus prepared, is laid on the plank of the press; over the plate is laid the paper, first well moistened, to receive the impression, and over the paper two or three folds of flannel. Things thus disposed the arms of the press are pulled and by that means the plate with its furniture passed through between the rollers, which pinching very strongly, yet equally, presses the moistened paper into the strokes of the engraving, whence it licks out the ink.

**PRIOR**, the superior of a convent of monks, or the next under the abbot. See **ABBOT**.

**PRISCILLIANISTS**, in church-history, Christian heretics, so called from their leader Priscillian, a Spaniard by birth, and bishop of Avila. He is said to have practised magic, and to have maintained the principal errors of the Manichees; but his peculiar tenet was, that it is lawful to make false oaths, in order to support one's cause and interest.

**PRISM**, an oblong solid, contained under more than four planes whose bases are equal, parallel, and alike situated.

**PRIVATEERS**, in maritime affairs, a kind of private ships of war, fitted out by private persons at their own expence; who have leave granted them to keep what they can take from the enemy, allowing the admiral his share. See **LETTER of Marque**.

**PRIVATION**, in general, denotes the absence or want of something; in which sense, darkness is only a privation of light.

**PRIVATIVE**, in grammar, a particle which, when prefixed to a word, changes it into a contrary sense. See **GRAMMAR**.

**PRIVET**, in botany. See **LIGISTRUM**.

**PRIVILEGE**, in law, some peculiar benefit granted to certain persons or places, contrary to the usual course of the law.

Privileges are said to be personal or real. Personal privileges are such as are extended to peers, ambassadors, members of parliament and of the convocation, and their menial servants, &c. See **PEER**, **EMBASSADOR**, **PARLIAMENT**, &c.

**PRIVILEGED DEBTS**, in Scots law. See **LAW**, Tit. xxviii. 19.

**PRIVY-COUNCIL**. See **Privy-COUNCIL**.

**PRIVY SEAL**. See **SEAL**.

**PRIZE**, in maritime affairs, a vessel taken at sea from the enemies of a state, or from pirates; and that either by a man of war, a privateer, &c. having a commission for that purpose.

**PROBABILITY**, is nothing but the appearance of the agreement or disagreement of two ideas by the intervention of proofs whose connection is not constant and immutable, or is not perceived to be so; but is, or appears for the most part to be so; and is enough to induce the mind to judge the proposition to be true or false, rather than the contrary. See **LOGIC** and **METAPHYSICS**.

**PROBATE** of a will or testament, in law, is the exhibiting and proving of last wills and testaments before the

ecclesiastical judge delegated by the bishop who is ordinary of the place where the party died.

**PROBATION**, in the universities, is the examination and trial of a student who is about to take his degrees.

**PROBATION**, in Scots law. See **LAW**, Tit. xxxi. 1, *et seq.*

**PROBATIONER**, in the church of Scotland, a student in divinity, who bringing a certificate from a professor in an university of his good morals, and his having performed his exercises to approbation, is admitted to undergo several trials.

**PROBE**, a surgeon's instrument for examining the circumstances of wounds, ulcers, and other cavities, searching for stones in the bladder, &c.

**PROBLEM**, in logic, a proposition that neither appears absolutely true nor false; and, consequently, may be asserted either in the affirmative or negative.

**PROBLEM**, in geometry, is a proposition, wherein some operation or construction is required; as to divide a line or angle, erect or let fall perpendiculars, &c. See **GEOMETRY**.

**PROBOSCIS**, in natural history, is the trunk or snout of an elephant, and some other animals and insects.

**PROCATARCTIC CAUSE**, in medicine, the pre-existing, or pre-disposing cause or occasion of a disease.

**PROCELEUSMATICUS**, in the ancient poetry, a foot consisting of four short syllables, or two pyrrhichiauses; as, *hominibus*,

**PROCELLARIA**, in ornithology, a genus of birds, belonging to the order of anseres. The beak is somewhat compressed, and without teeth; the mandibles are equal, the superior one being crooked at the point; the feet are palmated, the hind-claw being sessil, without any toe. There are six species, principally distinguished by their colour.

**PROCESS**, in law, denotes the proceedings in any cause, real or personal, civil or criminal, from the original writ to the end thereof.

**PROCESS**, in chemistry, the whole course of an experiment or series of operations tending to produce something new.

**PROCESS**, in anatomy, denotes any protuberance or eminence in a bone.

**PROCESSION** a ceremony in the Romish church, consisting of a formal march of the clergy and people, putting up prayers, &c. and in this manner visiting some church, &c. They have also processions of the host or sacrament. See **HOST**.

**PROCLAMATION**, a public notice given of any thing of which the king thinks proper to advertise his subjects.

Proclamations are a branch of the king's prerogative; and no person can make them without the king's authority, except mayors of towns, &c. by custom of privilege. Proclamations which require the people to do or not to do certain things, have the force of laws; but then they are supposed to be consistent with the laws already in being, otherwise they are superseded.

**PROCONSUL**, a Roman magistrate, sent to govern a province with consular authority.

**PROCREATION**, the begetting and bringing forth children. See **GENERATION** and **MIDWIFERY**.

**PROCTOR**, a person commissioned to manage another person's cause in any court of the civil or ecclesiastical law.

**PROCURATION**, an act or instrument by which a person

- is impowered to treat, transact, receive, &c. in another person's name.
- PROCURATOR**, a person who has a charge committed to him to act for another.
- PROCYON**, in astronomy. See **ASTRONOMY**, p. 487.
- PRODUCT**, in arithmetic. See **ARITHMETIC**, p. 371.
- PROFANATION**, the acting disrespectfully to sacred things.
- PROFANE**, a term used in opposition to holy; and, in general, is applied to all persons who have not the sacred character, and to things which do not belong to the service of religion.
- PROFESSION**, among the Romanists, denotes the entering into a religious order, whereby a person offers himself to God by a vow of inviolably observing obedience, chastity, and poverty.
- PROFESSOR**, in the universities, a person who teaches or reads public lectures in some art or science from a chair for the purpose.
- PROFILE**, in architecture, the draught of a building, fortification, &c. wherein are expressed the several heights, widths, and thickneses, such as they would appear were the building cut down perpendicularly from the roof to the foundation.
- PROFLUVIUM**, in medicine, denotes a flux, or liquid evacuation, of any thing.
- PROGNOSTICS**, among physicians, signifies a judgment concerning the event of a disease; as, whether it shall end in life or death, be short or long, mild or malignant, &c.
- PROGRESSION**, in general, denotes a regular advancing, or going forward in the same course and manner. See **ARITHMETIC**, **ALGEBRA**, and **GEOMETRY**.
- PROJECTION**, in mechanics, the act of communicating motion to a body, from thence called projectile. See **MECHANICS**.
- PROJECTURE**, in architecture, the out-jetting, promiency, or embossing, which the mouldings and other members have beyond the naked wall, column, &c. See **ARCHITECTURE**.
- PROLAPSUS**, in surgery, a prolapsion, or falling out of any part of the body from its natural situation; thus we say prolapsus intestini, a prolapsion of the intestine, &c. See **SURGERY**.
- PROLATE**, in geometry, an epithet applied to a spheroid produced by the revolution of a semi-ellipsis about its larger diameter.
- PROLEGOMENA**, certain preparatory observations or discourses prefixed to a book, &c. containing something necessary for the reader to be apprised of, to enable him the better to understand the book, or to enter deeper into the science, &c.
- PROLEPSIS**, a figure in rhetoric, by which we anticipate or prevent what might be objected by the adversary.
- PROLEPTIC**, an epithet applied to a periodical disease which anticipates, or whose paroxysm returns sooner and sooner every time, as is frequently the case in agues.
- PROLIFIC**, something that has the qualities necessary for generating.
- PROLIXITY**, in discourse, the fault of entering into too minute a detail, of being too long, precise, and circumstantial, even to a degree of tediousness.
- PROLOGUE**, in dramatic poetry, a discourse addressed to the audience before the drama or play begins. The original intention was to advertise the audience of the subject of the piece, and to prepare them to enter more easily into the action, and sometimes to make an apology for the poet.
- PROMETHEUS**, in the ancient astronomy, the name of the constellation now called Hercules. See **ASTRONOMY**, p. 487.
- PROMISE**, in law, is when upon any valuable consideration one binds himself by word of mouth to another to perform a thing agreed on.
- PROMONTORY**, in geography, a high point of land or rock projecting out into the sea; the extremity of which towards the sea, is called a cape, or headland.
- PROMULGATED**, something published or proclaimed, and generally applied to a law, to denote the publishing or proclaiming to the people.
- PRONATION**. See **ANATOMY**, p. 179.
- PRONATORS**, in anatomy. See **ANATOMY**, p. 198.
- PRONOUN**, in grammar, a declinable part of speech, which being put instead of a noun, points out some person or thing. See **GRAMMAR**.
- PRONUNCIATION**, in grammar, the manner of articulating or sounding the words of a language. See **GRAMMAR**.
- PROOF**, in law, &c. denotes the mediums or arguments used to evince the truth of any thing.
- PROPAGATION**, the act of multiplying the kind. See **GENERATION**.
- PROPER**, something naturally and essentially belonging to any thing.
- PROPERTY**, in a general sense, that which constitutes or denominates a thing proper; or it is a particular virtue or quality which nature has bestowed on some things exclusive of all others: thus colour is a property of light; extension, figure, divisibility, and impenetrability, are properties of body.
- PROPERTY**, in law, is described to be the highest right a person has, or can have, to any thing.
- PROPHECY**, a prediction made by divine inspiration.
- PROPHET**, in general, a person who foretells future events; but is particularly applied to such inspired persons among the Jews as were commissioned by God to declare his will and purposes to that people. Among the canonical books of the Old Testament, we have the writings of sixteen prophets, four of which are denominated the greater prophets, *viz.* Isaiah, Jeremiah, Ezekiel, and Daniel, so called from the length or extent of their writings, which exceed those of the others, *viz.* Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, and Malachi, who are called the lesser prophets from the shortness of their writings. The Jews do not place Daniel among the prophets, because, they say, he lived the life of a courtier rather than that of a prophet.
- PROPIIATION**, in theology, a sacrifice offered to God to assuage his wrath, and render him propitious. Among the Jews there were both ordinary and public sacrifices— as holocausts, &c. offered by way of thanksgiving; and extraordinary ones, offered by particular persons guilty of any crime, by way of propitiation. The Romish church believe the mass to be a sacrifice of propitiation for the living and the dead. The reformed churches allow

- of no propitiation but that one offered by Jesus Christ on the cross.
- PROPOLIS**, the name of a certain substance more glutinous and tenacious than wax, with which the bees stop up all the holes or cracks in the sides of their hives. See **APIS**.
- PROPONTIS**, or *Sea of MARMORA*, divides Europe from Asia; having the Bosphorus on the north-east, by which it has a communication with the Euxine sea; and the Hellespont on the south-west, by which it communicates with the Archipelago. It is one hundred and twenty miles long, and in some places upwards of forty broad.
- PROPORTION**. When two quantities are compared one with another, in respect of their greatness or smallness, the comparison is called ratio, rate, or proportion. See **ALGEBRA**, **ARITHMETIC**, and **GEOMETRY**.
- PROPOSITION**, in logic, part of an argument wherein some quality, either negative or positive, is attributed to a subject. See **LOGIC**.
- PROPOSITION**, in mathematics, is either some truth advanced, and shewn to be such by demonstration; or some operation proposed, and its solution shewn.
- PROPREFECT**, among the Romans, the prefect's lieutenant, or an officer whom the prefect of the pretorium commissioned to do any part of his duty in his place.
- PROPRETOR**, a Roman magistrate, who, having discharged the office of pretor at home, was sent into a province to command there with his former pretorial authority.
- PROROGATION**, the act of prolonging, adjourning, or putting off to another time. The difference between a prorogation and an adjournment of parliament is, that by prorogation the session is ended, as such bills as passed in either house, or both houses, and had not the royal assent, must at the next assembly begin again.
- PROSCRIPTION**, a publication made in the name of the chief or leader of a party, whereby he promises a reward to any one who shall bring him the head of one of his enemies.
- PROSE**, the natural language of mankind, loose, and unconfined by poetical measures, rhymes, &c. in which sense it stands opposed to verse.
- PROSECUTOR**, in law, he that pursues a cause in another's name.
- PROSELYTE**, a new convert to some religion or religious sect.
- PROSPERPINACA**, in botany, a genus of the triandria trigynia class. The calix consists of three segments; it has no corolla, and but one seed. There is only one species, a native of Virginia.
- PROSODY**, that part of grammar which treats of the quantities and accents of syllables. See **GRAMMAR**.
- PROSOPOPEIA**, a figure in rhetoric, whereby we raise qualities of things inanimate into persons.
- PROSTATÆ**, in anatomy. See **ANATOMY**, p. 273.
- FROSTYLE**, in architecture, a range of columns in the front of a temple.
- PROTEA**, in botany, a genus of the tetrandria monogynia class. The petal consists of four segments surrounding the germen; it has no proper calix; and the receptacle is paleaceous. There are two species, both natives of the Cape of Good Hope.
- PROTECTOR**, a person who undertakes to shelter and defend the weak, helpless, and distressed.
- PROTESTANT**, a name first given in Germany to those who adhered to the doctrine of Luther; because, in 1520, they protested against a decree of the emperor Charles V. and the diet Spire; declaring that they appealed to a general council. The same name has also been given to those of the sentiments of Calvin, and is now become a common denomination for all those of the reformed churches.
- PROTHONOTARY**, a term which properly signifies first notary, and which was anciently the title of the principal notaries of the emperors of Constantinople.
- PROTOTYPE**, is the original or model after which a thing was formed; but chiefly used for the patterns of things to be engraved, cast, &c.
- PROTRACTOR**, the name of an instrument used for protracting or laying down on paper the angles of a field, or other figure. See **GEOMETRY**.
- PROTUBERANCE**, is an eminence, whether natural or preternatural, that projects or advances out beyond the rest.
- PROVEDITOR**, an officer in several parts of Italy, particularly at Venice, who has the direction of matters relating to policy.
- PROVENCE**, a province or government of France, bounded by Dauphine on the north; by Piedmont on the east; by the Mediterranean on the south; and by the river Rhone, which separates it from Languedoc, on the west: it is about an hundred miles long, and near a many broad.
- PROVERB**, according to Camden, is a concise, witty, and wise speech, grounded upon experience, and for the most part containing some useful instructions.
- Book of PROVERBS*, a canonical book of the Old Testament, containing a part of the proverbs of Solomon the son of David king of Israel. The first twenty-four chapters are acknowledged to be the genuine work of that prince; the next five chapters are a collection of several of his proverbs, made by order of king Hezekiah; and the two last seem to have been added, though belonging to different and unknown authors, Agur the son of Jakeh, and king Lemuel.
- In this excellent book are contained rules for the conduct of all conditions of life; for kings, courtiers, masters, servants, fathers, mothers, children, &c.
- PROVIDENCE**, the conduct and direction of the several parts of the universe, by a superior intelligent Being.
- PROVIDENCE-PLANTATION**, a colony of New-England, which, with Rhode-Island, constitutes a charter government: its chief town is Newport.
- PROVIDENCE** is also one of the Bahama islands, planted and fortified by the English: W. long. 78°, N. lat. 25°.
- PROVINCE**, in Roman antiquity, a country of considerable extent, which, upon being entirely reduced under the Roman dominion, was new-modelled according to the pleasure of the conquerors, and subjected to the command of annual governors sent from Rome; being commonly obliged to pay such taxes and contribution as the senate thought fit to demand.
- PROVINCE**, in geography, a division of a kingdom or state, comprising

comprising several cities, towns, &c. all under the same government, and usually distinguished by the extent either of the civil or ecclesiastical jurisdiction.

**PROVINCIAL**, something relating to a province. See the preceding article.

**PROVOST**, of a city or town, is the chief municipal magistrate in several trading cities, particularly Edinburgh, Paris, &c. being much the same with mayor in other places.

He presides in city-courts, and, together, with the bailles, who are his deputies, determines in all differences that arise among citizens.

The provost of Edinburgh, as well as of all the other considerable towns in Scotland, has the title of lord; and the former calls yearly conventions of the royal boroughs to Edinburgh by his messives.

**PROW**, denotes the head or fore part of a ship, particularly in a galley, being that which is opposite to the poop or stern.

**PROXIMITY**, denotes the relation of nearness, either in respect of place, blood, or alliance.

**PROXY**, a person who officiates as a deputy in the room of another.

**PRUCH**, or **BRUGG**, a town of Austria, in Germany, twenty-two miles south-east of Vienna.

**PRUCK**, or **BRUCH**, of Stiria, in Germany, sixty miles south-west of Vienna.

**PRUNES**, are plumbs dried in the sunshine, or in an oven.

**PRUNING**, in gardening and agriculture, is the lopping off the superfluous branches of trees, in order to make them bear better fruit, grow higher, or appear more regular.

**PRUNUS**, in botany, a genus of the icofandria monogynia class. The calix consists of five segments, and the corolla of five petals; and the shell of the drupe is full of prominent sutures. There are 13 species, five of them natives of Britain, *viz.* the infirtia, or black bullace-tree; the spinosa, or sloe-tree; the padus, or birds cherry; the avium, or common wild cherry; and the cerasus, or black cherry.

**PRURITIS**, denotes an itching sensation.

**PRUSSIA**, a province of Poland, situated on the coast of the Baltic sea, and divided into regal and ducal Prussia, the first subject to Poland, and the last to the king of Prussia.

**PRYTANES**, in Grecian antiquity, were the presidents of the senate, whose authority consisted chiefly in assembling the senate; which, for the most part, was done once every day.

The senate consisted of five hundred, fifty senators being elected out of each tribe; after which, lots were cast, to determine in what order the senators of each tribe should preside, which they did by turns, and during their presidentship were called prytanes. However, all the fifty prytanes of the tribes did not govern all at once, but ten at a time, *viz.* for seven days; and after thirty-five days, another tribe came into play, and presided for other five weeks; and so of the rest.

**PSALM**, a divine song or hymn; but chiefly appropriated to the hundred and fifty Psalms of David, a canonical book of the Old Testament.

Most of the Psalms have a particular title, signifying either the name of the author, the person who was to set it

to music or sing it, the instrument that was to be used, or the subject and occasion of it. Some have imagined, that David was the sole author of the book of Psalms; but the titles of many of them prove the contrary, as Psalm xix. which appears to have been written by Moses. Many of the Psalms are inscribed with the names Korah, Jeduthun, &c. from the persons who were to sing them.

**PSALMODY**, the art or act of singing psalms. See the preceding article.

**PSALTER**, the same with the book of Psalms. See **PSALM**.

Among the religious, in the Popish countries, the term psalter is also given to a large chaplet or rosary, consisting of an hundred and fifty beads, according to the number of psalms in the psalter.

**PSALTERY**, a musical instrument, much in use among the ancient Hebrews, who called it nebel.

We know little or nothing of the precise form of the ancient psaltery.

**PSIDIUM**, in botany, a genus of the icofandria monogynia class. The calix consists of five segments, and the corolla of five petals; the berry has but one cell, containing many seeds. There are two species, both natives of India.

**PSITTACUS**, in ornithology, a genus belonging to the order of picæ. The beak is hooked, the superior mandible being furnished with a moveable wax; the nostrils are placed at the base of the beak; the tongue is fleshy, blunt, and entire; and the feet are fitted for climbing. There are 47 species, distinguished by their colour, and the length of their tails. This genus includes the parrot-kind, which are all natives of warm climates.

**PSOAS**, in anatomy. See **ANATOMY**, p. 203.

**PSORALIA**, in botany, a genus of the diadelphia decandria class. The calix is interspersed with fleshy points, of the length of the legumen, which contains one seed. There are 14 species, none of them natives of Britain.

**PTARMICA**, in botany. See **ACHILLEA**.

**PTELEA**, in botany, a genus of the tetrandia monogynia class. The calix consists of four segments, and the corolla of four petals; the fruit is a roundish membrane, with one seed in the centre. The species are two, none of them natives of Britain.

**PTERIS**, in botany, a genus of the cryptogamia filicum class. The fructification is situate in lines near the margin. There are 19 species, only one of them, *viz.* the aquilina, or female fern, is a native of Britain.

**PTERYGOID**, something resembling a wing.

**PTERYGOIDÆUS**, in anatomy. See **ANATOMY**, p. 221.

**PTISAN**, is properly barley decorticated, or deprived of its hulls, by beating in a mortar, as was the ancient practice, though the cooling potion, obtained by boiling such barley in water, and afterwards sweetening the liquor with liquorice-root, is what at present goes by the name of ptisan: and to render it laxative, some add a little senna, or other herb of the same intention.

**PTOLEMAIC System of Astronomy**, is that invented by Claudius Ptolemæus, a celebrated astronomer and mathematician of Pelusium, in Egypt, who lived in the beginning of the 11d century of the Christian æra.

This hypothesis supposes the earth immoveably fixed in the centre, not of the world only, but also of the universe:

verse; and that the sun, the moon, the planets, and stars, all move about it, from east to west, once in twenty-four hours, in the order following, *viz.* the moon next to the earth, then mercury, venus, the sun, mars, jupiter, saturn, the fixed stars, the first and second crystalline heavens, and above all the fiction of their primum mobile.

**PTYALISM**, in medicine, a salivation, or frequent and copious discharge of saliva.

**PUBERTY**, among civilians, &c. the age wherein a person is capable of procreation, or begetting children. See **LAW**.

**PUBES**, among anatomists, &c. denotes the middle part of the hypogastric region of the abdomen, lying between the two inguina or groins. See **ANATOMY**, p. 257.

**PUBLICAN**, among the Romans, one who farmed the taxes and public revenues.

**PUBLICATION**, the act of making a thing known to the world; the same with promulgation.

**PUDENDA**, the parts of generation in both sexes. See **ANATOMY**, p. 270.

**PUERILITY**, in discourse, is defined by Longinus, to be a thought, which, by being too far-fetched, becomes flat and insipid. Puerility, he adds, is the common fault of those who affect to say nothing but what is brilliant and extraordinary.

**PUGIL**, in physic, &c. such a quantity of flowers, seeds, or the like, as may be taken up between the thumb and two fore-fingers.

It is esteemed to be the eighth part of the manipule or handful.

**PULEX**, in zoology, a genus of insects belonging to the order of aptera. It has six feet fitted for leaping, and two eyes; the feelers are like threads; the rostrum is inflected, setaceous, and armed with a sting; and the belly is compressed. There are two species, *viz.* the irritans, with a proboscis shorter than its body, a native of Europe and America: and the penetrans, with a proboscis longer than its body, a native of America.

**PULLEY**, in mechanics, one of the mechanical powers. See **MECHANICS**.

**PULMO**, the **LUNGS**, in anatomy. See **ANATOMY**, p. 280.

**PULMONARIA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel-shaped; and the calix has five sides. There are seven species, two of them natives of Britain, *viz.* the officinalis, or bugloss-cowslips, the leaves of which are reckoned pectoral and cordiac; and the maritima, or sea-bugloss.

**PULMONARY VESSELS**, in anatomy. See **ANATOMY**, Part III. and IV. and p. 280.

**PULP**, in pharmacy, the fleshy and succulent part of fruits, extracted by infusion or boiling, and passed through a sieve.

**PULPIT**, an elevated place in a church, whence sermons are delivered: the French give the same name to a reading desk.

**PULSATILLA**, in botany. See **ANEMONE**.

**PULSE**, in the animal œconomy, denotes the beating or throbbing of the heart and arteries.

With regard to motion, the pulses are reckoned only four, great and little, quick and slow. When quickness and greatness are joined together, it becomes violent; and when it is little and slow, it is called a weak pulse.

They are also said to be frequent and rare, equal and unequal; but these are not the essential affections of motion. Frequency and quickness are often confounded with each other. A pulse is said to be hard or soft, with regard to the artery, according as it is tense, renitent, and hard, or flaccid, soft, and lax. Add to these, a convulsive pulse; which does not proceed from the blood, but from the state of the artery, and is known by a tremulous subfultory motion, and the artery seems to be drawn upwards: this, in acute fevers, is the sign of death; and is said to be the pulse in dying persons, which is likewise generally unequal and intermitting. A great pulse shews a more copious afflux of the blood to the heart, and from thence into the arteries; a little pulse, the contrary.

**PULSE** is also used for the stroke with which any medium is affected by the motion of light, sound, &c. through it.

**PULSE**, in botany, a term applied to all those grains or seeds which are gathered with the hand, in contradistinction to corn, &c. which are reaped, or mowed: or it is the seed of the leguminous kind of plants, as beans, vetches, &c. but it is by some used for artichokes, asparagus, &c.

**PULVERIZATION**, the art of pulverizing, or reducing a dry body into a fine powder; which is performed in friable bodies, by pounding or beating them in a mortar, &c.

**PULVIS**, a **POWDER**. See **POWDER**.

**PUMICE**, in natural history, a slag or cinder of some fossil, originally bearing another form, and only reduced to this state by the action of the fire, though generally ranked by authors among the native stones. It is a lax and spongy matter, frequently of an obscure-friated texture in many parts, and always very cavernous and full of holes; it is hard and harsh to the touch, but much lighter than any other body that comes under the class of stones. It is found in masses of different sizes, and of a perfectly irregular shape, from the bigness of a pigeon's egg, to that of a bushel. We have it from many parts of the world, but particularly from about the burning mountains *Ætna*, *Vesuvius*, and *Hecla*, by whose eruptions it is thrown up in vast abundance; and being by its lightness supported in the air, is carried into seas at some distance by the winds, and thence to distant shores. The great use of the pumice among the ancients, seems to have been as a dentifrice, and at present it is retained in the shops on the same account.

**PUMP**, in hydraulics. See **HYDROSTATICS**; p. 808. &c. *Air-PUMP*. See **PNEUMATICS**, p. 491.

**PUN**, or **PUNN**, a conceit arising from the use of two words that agree in sound, but differ in the sense. Aristotle describes two or three kinds of puns among the beauties of good writing, and produces instances of them out of some of the greatest authors in the Greek tongue. Cicero has sprinkled several of his works with puns; and in his book, where he lays down the rules of oratory, quotes abundance of sayings, which he calls pieces of wit, that upon examination prove perfect puns.

**PUNCH**, an instrument of iron or steel, used in several arts, for the piercing or stamping holes in plates of metal, &c. being so contrived as not only to perforate, but to cut out and take away the piece.

**PUNCHEON**, a little block or piece of steel, on one end whereof is some figure, letter, or mark, engraven either

in creux or relieve; impressions whereof are taken on metal, or some other matter, by striking it with a hammer on the end not engraved.

**PUNcheon** is also a measure for liquids, containing an hog-head and one third, or eighty-four gallons.

**PUNCTUATION**, in grammar, the art of pointing, or of dividing a discourse into periods, by points expressing the pauses to be made in the reading thereof.

**PUNCTUM SALIENS**, in anatomy, the first rudiments of the heart in the formation of the fœtus, where a throbbing motion is perceived.

**PUNCTURE**, in surgery, any wound made by a sharp-pointed instrument.

**PUNICA**, the **POMEGRANATE-TREE**, in botany, a genus of the icofandria monogynia class. The calix consists of five segments, and the corolla of five petals; the apple has many cells, containing many seeds. There are two species, both natives of warm climates.

**PUNISHMENT**, in law, the penalty which a person incurs on the breach or transgression of any law.

**PUPIL**, in the civil law, a boy or girl not yet arrived at the age of puberty, *i. e.* the boy under fourteen years, the girl under twelve.

**PUPIL** is also used in universities, &c. for a youth under the education or discipline of any person.

**PUPIL**, in anatomy. See **ANATOMY**, p. 289.

**PURCHASE**, in law, the buying or acquiring of lands, &c. with money, by deed or agreement, and not by descent or right of inheritance.

**PURE**, something free from any admixture of foreign or heterogeneous matters: thus we say pure fire, &c.

**PURFLEW**, a term in heraldry, expressing ermins, peans, or any of the furs, when they compose a bordure round a coat of arms: thus they say, he beareth gules a bordure, purflew, vairy; meaning that the bordure is vairy.

**PURGATION**, the art of purging, scouring, or purifying a thing, by separating, or carrying off any impurities found therein: thus,

**PURGATIVE**, a medicament which evacuates the impurities of the body by stool, called also cathartics.

**PURGATORY**, a place in which the just who depart out of this life, are supposed to expiate certain offences which do not merit eternal damnation.

Broughton has endeavoured to prove, that this notion has been held by Pagans, Jews, and Mahometans, as well as by Christians.

The doctrine of purgatory is a very lucrative article to the clergy of the Romish church, who are very liberally paid for masses and prayers for the souls of the deceased. We are told by some of their doctors, that purgatory is a subterraneous place situated over the hell of the damned, where such souls as have not yet made satisfaction to divine justice for their sins, are purged by fire, after a wonderful and incomprehensible manner; and here they are purified from those dregs which hinder them from entering into their eternal country, as the catechism of the council of Trent expresses it.

**PURIFICATION**, in matters of religion, a ceremony which consists in cleansing any thing from a supposed pollution or defilement.

The Pagans, before they sacrificed, usually bathed or washed themselves in water; and they were particularly careful to wash their hands, because with these they were

to touch the victims consecrated to the gods. It was also customary to wash the vessel with which they made their libations. The Mahometans use purifications as previous to the duty of prayer: these also are of two kinds; either bathing; or only washing the face, hands and feet. The first is requested only in extraordinary cases, as after having lain with a woman, touched a dead &c. But lest so necessary a preparation for their devotion should be omitted, either where water cannot be had, or when it may be of prejudice to a person's health, they are allowed in such cases to make use of fine sand or dust instead of it; and then they perform this duty by clapping their open hands on the sand, and passing them over the parts, in the same manner as if they were dipped in water.

There were also many legal purifications among the Hebrews. When a woman was brought to bed of a male-child, she was esteemed impure for forty days; and when of a female, for sixty; at the end of which time she carried a lamb to the door of the temple, to be offered for a burnt-offering, and a young pigeon or turtle for a sin-offering, and by this ceremony she was cleansed or purified.

**PURIM**, or *the feast of lots*, a solemn festival of the Jews, instituted in memory of the deliverance they received from Haman's wicked attempt to destroy them, by means of Mordecai and Esther.

**PURITAN**, a name formerly given in derision to the dissenters from the church of England, on account of their professing to follow the pure word of God, in opposition to all traditions and human constitutions.

**PURLINS**, in building, those pieces of timber that lie across the rafters on the inside, to keep them from sinking in the middle of their length.

**PURLUE**, or **PURLIEU**, signifies all that ground near any forest, which being made forest by king Henry II. Richard I. and king John, was afterwards by perambulations and grants of Henry III. severed again from the same, and made purlieu; that is to say, pure and free from the laws of the forest.

**PURPLE**, a colour composed of a mixture of red and blue.

A beautiful transparent purple for painting may be made by boiling four ounces of rasped brasil-wood in a pint of stale beer, and half an ounce of logwood, till the liquor is heightened to the colour you desire, which may be known by dipping a piece of paper in it. If you find it too red, add a quarter of an ounce more of logwood, which will render it still deeper; and by this method you may bring it to any degree of purple, by putting in either more or less logwood to the former composition, and fixing it with alum.

**PURPURA**, in natural history. See **MUREX**.

**PURPURE**, or **PURPLE**, in heraldry, according to some, is one of the five colours of armories, compounded of gules and azure, bordering on violet, and, according to others, of a great deal of red and a little black. But it was excluded by the ancient heralds as only an imperfect colour. In the coats of noblemen it is called amethyst; and in those of princes, mercury. It is represented in engraving, by diagonal lines drawn from the sinister chief to the dexter base points. See Plate CXLVII. fig. 3.

**PURSER**, an officer aboard a man of war, who receives her victuals from the victualler, sees that it be well stowed,

and keeps an account of what he every day delivered to the steward. He also keeps a list of the ship's company, and sets down exactly the day of each man's admission, in order to regulate the quantity of provisions to be delivered out, and that the paymaster or treasurer of the navy may issue out the disbursements, and pay off the men, according to his book.

**PURSLAIN**, in botany. See **PORTULACA**.

**PURVIEW**, a term used by some lawyers for the body of an act of parliament, or that part which begins with, Be it enacted, &c. as contradistinguished from the preamble.

**PURULENT**, in medicine, something mixed with, or partaking of, pus or matter.

**PUS**, in medicine, a white or yellowish putrid matter, designed by nature for the healing and cementing of wounds or sores.

**PUSTULE**, a pimple, or small eruption on the skin full of pus; such are the pustules of the small-pox and french-pox. See **MEDICINE**.

**PUTORIUS** in zoology. See **MUSTELA**.

**PUTREFACTION** See **CHEMISTRY**, p. 98.

**PUTTY**, is a kind of paste, compounded of whiting and linseed oil, beaten together to the consistence of thick dough.

It is used by glaziers for the fastening in the squares of glass in sash-windows, and by painters for stopping up the crevices and clefts in timber and wainscots, &c.

**PYCNOSYLE**, in the ancient architecture, is a building where the columns stand very close to each other; only one diameter and a half of the column being allowed for the intercolumniations.

**PYGARGUS**, in ornithology. See **FALCO**.

**PYGMY**, a person not exceeding a cubit in height.

This appellation is given by the ancients to a fabulous nation said to have inhabited Thrace; who brought forth young at five years of age, and were old at eight; these were famous for the bloody war they waged with the cranes.

**PYLORUS**, in anatomy. See **ANATOMY**, p. 258.

**PYRAMID**, in geometry, a solid standing on a triangular, square, or polygonal basis, and terminating in a point at the top; or, according to Euclid, it is a solid figure, consisting of several triangles, whose bases are all in the same plane, and have one common vertex.

**PYRAMID**, in architecture, a solid massive building, which from a square, triangular, or other base, rises diminishing to a vertex or point.

Pyramids are sometimes used to preserve the memory of singular events; and sometimes to transmit to posterity the glory and magnificence of princes. But as they are esteemed a symbol of immortality, they are most commonly used as funeral monuments. Such is that of Cestius at Rome; and those other celebrated ones of Egypt, as famous for the enormity of their size, as their antiquity. These are situated on the west side of the Nile, almost opposite to Grand Cairo: the base of the largest covers more than ten acres of ground; and is, according to some, near seven hundred feet high; though others make it but six hundred, and some but little more than five hundred. The pyramid is said to have been, among the Egyptians, a symbol of human life; the beginning of which is represented by the base, and the end by the

apex; on which account it was that they used to erect them over sepulchres.

**PYRAMIDALIA CORPORA**, in anatomy. See **ANATOMY**, p. 287.

**PYRAMIDALIS**, in anatomy. See **ANATOMY**, p. 193.

**PYRENEAN MOUNTAINS** divide France from Spain, and are not inferior to the Alps in height: they extend from the Mediterranean to the ocean, upwards of two hundred miles in length, the greatest breadth being about one hundred and twenty.

**PYRIFORMIS**, in anatomy. See **ANATOMY**, p. 205.

**PYRITES**. See **CHEMISTRY**, p. 117.

**PYRMONT**, the capital of a county of that name in the circle of Westphalia in Germany, situated on the confines of the duchy of Brunswick, in E. long. 9°, N. lat. 52°, from whence we receive the best mineral waters in Germany.

**PYROLA**, in botany, a genus of the decandria monogynia class. The calix consists of five segments, and the corolla of five petals; and the capsule has five cells. There are six species, three of them natives of Britain, viz. the rotundifolia, or common winter-green; the minor, or lesser winter-green; and the secunda, or dented leaved winter-green.

**PYROMANCY**, a kind of divination by means of fire. The ancients imagined they could foretell future events, by inspecting fire and flame; and to this end, they considered its direction, which way it turned; sometimes they added other matters to the fire, such as a vessel full of urine, having its neck bound about with wool, watching narrowly on which side it burst, and thence taking their augury: sometimes they threw pitch on it; and, if it took fire immediately, they esteemed it a good augury.

**PYROTECHNY**, the art of fire, or a science which teaches the management and application of fire in several operations. See **CHEMISTRY**.

**PYROTICS**, in medicine, caustics, or remedies, either actually or potentially hot; and which accordingly will burn the flesh, and raise an eschar. See **CAUSTICS**.

**PYRRHICHA**, in antiquity, a kind of exercise on horseback, or a feigned combat, for the exercise of the cavalry.

**PYRRHICHIUS**, in the Greek and Latin poetry, a foot consisting of two syllables, both short; as, *Deus*.

**PYRRHONIANS**, a sect of ancient philosophers, so called from Pyrrho, a native of Elis, in Peloponnesus. The opinions of these philosophers, who were also called sceptics, terminated in the incomprehensibility of all things, in which they found reason both for affirming and denying; accordingly they seemed, during their whole lives, to be in search of truth, without ever acknowledging that they had found it; hence the art of disputing upon all things, without ever going farther than suspending our judgment, is called pyrrhonism.

**PYRUS**, in botany, a genus of the icosandria pentagynia class. The calix consists of 5 segments, and the corolla of five petals; the apple has five cells, containing many seeds. There are four species, two of them natives of Britain, viz. the communis, or wild pear-tree; and the malus, or crab-apple.

**PYTHAGOREANS**, a sect of ancient philosophers, so called from their being the followers of Pythagoras of Samos, who lived in the reign of Tarquin the last king of the Romans, in the year of Rome 220; or, according

to Livy, in the reign of Servius Tullius, in the year of the world 3472.

His maxims of morality were admirable; for he was for having the study of philosophy solely tend to elevate man to a resemblance of the Deity. He believed that God is a soul diffused through all nature, and that from him human souls are derived; that they are immortal; and that men need only take pains to purge themselves of their vices, in order to be united to the Deity. He made unity the principle of all things; and believed, that between God and man there are various orders of spiritual beings, who are the ministers of the Supreme Being. He condemned all images of the Deity, and would have him worshipped with as few ceremonies as possible. His disciples brought all their goods into a common stock, contemned the pleasures of sense, abstained from swearing, eat nothing that had life, and believed in the doctrine of a metempsychosis. See METEMPSYCHOSIS.

Pythagoras made his scholars undergo a severe novitiate of silence for at least two years; and it is said, that where he discerned too great an itch for talking, he extended it to five. His disciples were therefore divided into two classes: of which the first were simple hearers;

and the last such as were allowed to propose their difficulties, and learn the reasons of all that was taught there. The Pythagoreans, it is said, on their rising from bed, roused the mind with the sound of the lyre, in order to make them more fit for the actions of the day; and at night resumed the lyre, in order to prepare themselves for sleep, by calming all their tumultuous thoughts. The figurative manner in which he gave his instructions, was borrowed from the Hebrews, Egyptians, and other orientals. Some think he derived his philosophy from the books of Moses, and that he conversed with Ezekiel and Daniel at Babylon; but this is mere conjecture.

Some authors say, that he left nothing in writing; but Laërtius and others attribute several treatises to him. His golden verses, attributed by some to one of his disciples, are allowed to be an exact copy of the sentiments of that divine philosopher, from whose school proceeded the greatest philosophers and legislators.

PYTHIA, in antiquity, the priestess of Apollo at Delphi, by whom he delivered oracles; she was thus called from the god himself, who was denominated Apollo Pythios, from his slaying the serpent Python.



## Q.

### Q U A

**QUACK**, among physicians, the same with empiric. See EMPIRIC.

**QUADRAGESIMA**, a denomination given to lent, from its consisting of forty days. See LENT.

**QUADRANGLE**, in geometry, the same with a quadrilateral figure, or one consisting of four sides and four angles.

**QUADRANS**, the quarter or fourth part of any thing, particularly the *as*, or pound.

**QUADRANT**, in geometry, the arch of a circle, containing 90°, or the fourth part of the entire periphery.

**QUADRANT** also denotes a mathematical instrument, of great use in astronomy and navigation, for taking the altitudes of the sun and stars. See ASTRONOMY, p. 451.

**QUADRAT**, a mathematical instrument, called also a geometrical square, and line of shadows: it is frequently an additional member on the face of the common quadrant, as also on those of Gunter's and Sutton's quadrant.

**QUADRAT**, in astrology, the same with quartile. See QUARTILE.

**QUADRAT**, in printing, a piece of metal cast like the letters, to fill up the void spaces between words, &c. There are quadrats of different sizes, as m-quadrats, n-quadrats, &c. which are, respectively, of the dimensions of these letters.

**QUADRATIC EQUATION**, in algebra. See ALGEBRA, p. 90.

**QUADRATRIX**, in geometry, a mechanical line, by means whereof we can find right lines equal to the circumference of circles, or other curves, and their several parts.

**QUADRATRIX** of *Dionstrates*, so called from its inventor

### Q U A

*Dionstrates*, is a curve, whereby the quadrature of the circle is effected mechanically.

**QUADRATURE**, in geometry, denotes the squaring, or reducing a figure to a square. Thus, the finding of a square, which shall contain just as much surface or area as a circle, an ellipsis, a triangle, &c. is the quadrature of a circle, ellipsis, &c. See GEOMETRY.

**QUADRATURE**, in astronomy, that aspect of the moon, when she is 90° distant from the sun. See ASTRONOMY.

**QUADRATUS**, in anatomy, a name given to several muscles on account of their square figure. See ANATOMY, Part II.

**QUADREL**, in building, a kind of artificial stone, so called from its being perfectly square.

The quadrels are made of chalky earth, &c. and dried in the shade for two years. These were formerly in great request among the Italian architects.

**QUADRIENNNUM UTILE**, in Scots law. See LAW, Tit. vii. 17.

**QUADRIGA**, in antiquity, a car or chariot drawn by four horses.

On the reverses of medals, we frequently see the emperor or victory in a quadriga, holding the reins of the horses; whence these coins are, among the curious, called nummi quadrigati, and victoriatii.

**QUADRILATERAL**, in geometry, a figure whose perimeter consists of four right lines, making four angles; whence it is also called a quadrangular figure.

**QUADRILLE**, a little troop or company of cavaliers, pompously dressed, and mounted for the performance of carousals,

rou'sals, juffs, tournaments, runnings at the ring, and other gallant divertifements.

**QUADRILLE**, is alfo a game at cards, to be learned only by practice.

**QUADRUPEDS**, in zoology. See **NATURAL HISTORY**.

**QUASICONTRACT**, in Scots law. See **LAW**, Tit. xxii. 14.

**QUESTUS**, in law, fignifies whatever a perfon has by purchafe; as hereditas denotes that which one has by defcent, or hereditary right.

**QUAIL**. See **TETRAO**.

**QUAKERS**, a religious fociety that began to be diftinguifhed by this name in England, where it firft took its rife, about the middle of the laft century.

In treating of this people, we fhall deviate from the generality of thofe who have mentioned them in their writings, by exhibiting the account which they give of themfelves, without making ourfelves anfwerable for their principles or their practices.

William Sewel, a Dutchman, publifhed; in the year 1717, the hiftory of this people. He was one of their perfuafion, a man of learning, and known to the public by his dictionary of the Dutch and Englifh languages. He had accefs to all their records, correfponded with the moft eminent, lived at the time when the facts he recorded were recent, and we have not heard that any part of his hiftory has been controverted; and as we are informed that it has been publifhed by the approbation of the quakers, we may therefore confider it as an authentic hiftory of their rife, progress, and principal opinions.

George Fox, (for whole birth and parentage, fee page 6th of Sewel's Hiftory, &c.) was the firft of this people. He was of a grave, fedate turn from his infancy; always averfe to the follies of youth, and defirous of nothing fo much as to be preferved in innocence and fimplicity. He was early remarked as an example in thefe refpects, and of inflexible integrity. When a youth, he was defirous above all things to pleafe God, and cautiously avoided every thing that either fcripture or the dictates of his own confcience taught him to believe were offensive. As he grew up, this difpofition increafed: it coft him much anxiety, much diftreff; but at length he was fatisfied in refpect to many doubts he had admitted, and gained much experience by the things he had fuffered. This enabled him to inftruct others; and about the year 1647, we find him travelling through feveral countries in England, feeking out fuch as had any religious tendernefs, and exciting the inquiries of many concerning him. Many embraced his opinions; and indeed he feems to have roused the public mind as much as any individual ever did in thofe countries, for the time and under fuch circumftances. A man of low birth, without literature, merely by the fanctity of his life, the fimplicity of his doctrines, to have collected from all profefions, and moft ranks, men of character, fortune, and underftanding, and embodied them as a religious fociety; to have instituted one of the beft concerted plans of civil difcipline; is a circumftance moft true, and not unworthy the difquifitions of the ableft philofophers.

The name of *Quaker* was fixed to this people early, by way of reproach. In their afsemblies it fometimes happened, that fome were fo far ftruck with the remembrance of their paff follies and forgetfulnefs of their condition, others fo deeply affected with a fenfe of God's

mercies to them, that they aftually trembled and quaked. The nickname fo fuitied the vulgar tafte, that it immediately became general. *Friends*, or *the friends of truth*, was the name they were commonly known by to one another; but the epithet abovementioned was ftamped upon them by their adverfaries, and perhaps indelibly.

The following abftract from the propofitions of our countryman, the eminent Barclay, will perhaps exhibit as clear a fummary of their opinions as can well be comprifed within the limits allowed to this article.

1. The height of all happinefs is placed in the true knowledge of God.
2. The true knowledge of God is alone to be obtained by the revelation of the Spirit of God.
3. The revelation of the Spirit of God to the faints has produced the fcriptures of truth.
4. From whence it appears, that mankind in general is fallen and degenerated.
5. That God out of his infinite love hath offered univerfal redemption by Chrift, who taffed death for every man.
6. That there is an evangelical and faving light and grace in all.
7. That as many as refift not this light, but receive the fame, in them are produced holinefs, righteoufnefs, purity, and the fruits which are acceptable to God.
8. Even fo as to arrive at a ftate of freedom from aftual finning and tranfgreffing the law of God;
9. Yet with a poffibility of finning.
10. That as all true knowledge in things fpiritual is received by the Spirit of God, fo by it every true minifter of the gofpel is ordained and prepared for the miniftry; and as they have freely received, fo are they freely to give.
11. That the true worfhip of God is in fpirit and in truth; not limited to place or time, or fubject to the intervention of any perfon; but is to be performed under the moving of the Holy Spirit in our hearts, yet without derogating from the neceffity and utility of public united worfhip, (in which their fufferings and conftancy have been moft remarkable).
12. That baptifm is a pure and fpiritual thing, the baptifm of the fpirit and fire.
13. That the communion of the body and blood of Chrift is inward and fpiritual.
14. That it is not lawful for any human authority to force the confciences of others on account of difference in worfhip or opinion, except fuch opinions tend to the prejudice of his neighbour in his life or eftate, or are inconffiftent with human fociety.
15. That as the end of religion is to redeem man from the fpirit of this world; and to lead into inward communion with God; therefore all vain customs and habits are to be rejected, which tend to divert the mind from a fenfe of the fear of God, and that evangelical fpirit wherewith Chriftians ought to be leavened.

Such are the fentiments of this people as propofed to the public by their apologet, who has largely commented on thefe topics in a work that has paffed through no lefs than eight editions in Englifh, and has been printed in moft of the modern languages.

Their particularities of address, language, and behaviour; their declining the ufe of arms, even in their own defence; their refufing to pay tithes, or contribute to the fupport of minifters in any fhape; likewise their refufing to swear or take an oath on any occafion whatever; have fubjected them to much obloquy, and many grievous fufferings. On what principles, and by what arguments, they vindicate themfelves from the objections raifed againft them by their adverfaries, may be feen in this elaborate

borate performance. Government has, however, in many instances, extended to this people great indulgencies; convinced, no doubt, by their patient suffering, that their professions of conscientious scruples were sincere, and that nothing dangerous to society could be apprehended from a people who disclaimed the use of arms both offensive and defensive. The œconomy of this society likewise deserves our notice. It appears by their history, that soon after the preaching of George Fox had drawn together in many parts of England considerable bodies of people professing the same opinions, he found it expedient for their better government to establish regular meetings for discipline. The following is, as nearly as we can collect, the plan that is established amongst them.

Where there are any Quakers, they meet together every month, to consider of the necessities of their poor, and to provide for their relief; to hear and determine complaints arising among themselves; to inquire into the conversation of their respective members in regard to morality and conformity to their religious sentiments; to allow the passing of marriages; and to enjoin a strict regard to the peace and good order of the society, the proper education of their young people, and a general attention to the principles and practices of their professions. In every country where there are monthly meetings, a meeting of the like kind is held, and for similar purposes, every quarter. This meeting consists of deputies sent from the several monthly meetings, who are charged with answers in writing to queries proposed to them respecting the good order of the society. At these meetings appeals are received, in case of any disputes; and differences settled, if possible. Advices are given as occasions offer, and assistance afforded to any of the monthly meetings, in case of a larger proportion of poor, or any similar expences. As there are Quakers in most parts of England, there are few counties which have not these quarterly meetings. And from these are deputed 4, 6 or 8 of their members once a-year to their annual assembly at London.

The annual meeting is commonly held in Whitsun-week, not from any superstitious reference, as they say, to the effusion of the Holy Ghost at the time of petecost, but merely as it is a season most generally convenient to the body. At this anniversary meeting, consisting of deputies from every quarterly meeting, and a number of the most judicious of their persuasion in London, selected for the purpose of acting on all emergencies for the good of the society, accounts are received of the state of the society in every part of the world where it exists. The deputies bring with them accounts signed by order of the respective quarterly meetings, informing the yearly meeting, if any difunion appears; if there is any neglect in regard to the religious education of their youth; if the poor are well provided for; if they keep to their testimony against paying tythes, against bearing arms; if they pay the king his duties, customs, and excise, and forbear to deal in goods suspected to be run. Appeals are here received, and finally determined; propositions received, and considered; and rules formed on particular emergencies: And, lastly, such advices are sent to the subordinate meetings as the particular or general state of the society requires.

Perhaps this is the only society in the world that have al-

lowed any share in the management of their affairs to the female sex; which they do upon the principle that male and female are one in Christ. Accordingly we find them in every department of their institution. They have women-preachers, for whom the celebrated Locke made an excellent apology. These have also their meetings of discipline; in which the like care is taken in regard to the female youth, and the good order of their sex, as is done by the men in respect to their own. And when we reflect what a number of individuals of both sexes are kept in good order by the police of this society, how few of them are brought into courts of justice as delinquents, how peaceable their behaviour, and how exemplary their conduct. We cannot but think their principles deserve a more accurate examination than has hitherto been attempted, owing perhaps to the vulgar prejudices circulated against them. We shall close this article with observing, that, according to the best of our information, neither their ministers, nor those who have the principal care of the society, enjoy any pecuniary emolument or advantages. A few clerks only receive salaries for keeping their records; so that perhaps there is not a religious society now existing, where principle has greater influence in promoting the ends of their institution.

It is remarkable, that all the settlements of the Europeans in America, except the Quaker settlement of Pennsylvania, were made by force of arms, with very little regard to any prior title in the natives. The kings of Spain, Portugal, France, and Britain, together with the States of Holland, then the only maritime powers, gave grants of such parts of America as their people could lay hold on, studying only to avoid interference with their European neighbours. But Mr Penn, being a Quaker, did not think his powers from king Charles II. a sufficient title to the country since called Pennsylvania: He therefore assembled the sachems or princes then in that country, and purchased from them the extent of land that he wanted. The government of this province is mostly in the hands of the Quakers, who never have any quarrels with the natives. When they desire to extend their settlements, they purchase new lands of the sachems, never taking any thing from them by force. How unlike is this conduct to that of the Spaniards, who murdered millions of the natives of Mexico, Terra Firma, Peru, Chili, &c. The barbarities used to these poor Indians in conquering their country, and forcing them to discover their gold, are a reproach to human nature.

**QUALITY**, is defined by Mr Locke, to be the power in a subject of producing any idea in the mind. See METAPHYSICS.

**Chemical QUALITIES**, those qualities principally introduced by means of chemical experiments, as fumigation, amalgamation, cupellation, volatilization, precipitation, &c. See CHEMISTRY.

**QUALITY** is also used for a kind of title given to certain persons, in regard of their territories, signories, or other pretensions.

**QUAMSI**, a province of China, bounded by the province of Yunan on the west, by Queycheu on the north, by Quantum on the east, and by Tonquin on the south.

**QUAMTUM**, or **CANTON**, a province of China, bounded by Huguam and Kiamsi on the north, by Foken on the east, by the ocean on the south, and by Quamsi on the west.

QUAN-

**QUANTITY**, any thing capable of estimation, or mensuration; or which, being compared with another thing of the same kind, may be said to be greater or less than it, equal or unequal to it. See **ARITHMETIC**, **ALGEBRA**, **GEOMETRY**.

**QUANTITY**, in grammar, an affection of a syllable, whereby its measure, or the time wherein it is pronounced, is ascertained; or that which determines the syllable to be long or short.

**QUARANTINE**, is used for a term of forty days, which vessels, coming from places suspected of contagion, are obliged to wait in certain places appointed to air themselves, before they come into port. See **LAZAR-HOUSE**.

**QUARRY**, a place under ground, out of which are got marble, free-stone, slate, lime-stone, or other matters proper for buildings.

**QUARRY OF QUARREL**, among glaziers, a pane of glass, cut in a diamond form.

**QUART**, a measure containing the fourth part of some other measure.

**QUARTAN**. in medicine, a species of intermitting fever. See **MEDICINE**.

**QUARTATION**, a method of purifying gold by melting three parts of silver with one of gold, and then throwing the mixture into aqua-fortis. See **CHEMISTRY**, p. 129.

**QUARTER**, the fourth part of any thing

**Quarter**, in weights, is generally used for the fourth part of an hundred weight averdupois, or 28 lb.

Used as the name of a dry measure, quarter is the fourth part of a ton in weight, or eight bushels.

**QUARTER**, in astronomy, the fourth part of the moon's period.

**QUARTER**, in heraldry, is applied to the parts or members of the first division of a coat that is quartered, or divided into four quarters. See **QUARTERING**.

**Franc-QUARTER**, in heraldry, is a quarter single or alone; which is to possess one fourth part of the field.

This makes one of the honourable ordinaries of a coat.

**QUARTER-MASTERS**, or **QUARTERS**, in a man of war, are officers whose business it is to rummage, stow, and trim the ship in the hold; to overlook the steward in his delivery of victuals to the cook, and in pumping or drawing out beer, or the like. They are also to keep their watch duly, in conning the ship, or any other duty.

**QUARTER-MASTER**, an officer in the army, whose business is to look after the quarters of the soldiers; of which there are several kinds, *viz.* The quarter-master general, whose business is to provide good quarters for the whole army; quarter-master of horse, he who is to provide quarters for a troop of horse; quarter-master of foot, he who is to provide quarters for a regiment of foot.

**QUARTERING**, in the sea language, is disposing the ship's company at an engagement, in such a manner as that each may readily know where his station is, and what he is to do.

**QUARTERING**, in heraldry, is dividing a coat into four or more quarters or quarterings, by parting, coupling, &c. that is, by perpendicular and horizontal lines, &c.

**QUATUOR VIR**. in antiquity, formerly written **IIII. VIR**, a Roman magistrate who had three colleges joined with him in the same administration, and had the care of conducting and settling the colonies sent into the provinces,

There were also quatuor-viri appointed to inspect and take care of repairs, &c.

**QUAVER**, in music, a measure of time equal to half a crotchet, or an eighth of a semibreve. See **MUSICK**.

**QUEBEC**, the capital of Canada, in North America, situated on the west side of the river of St Lawrence, 300 miles north-west of Boston in New England: W. long. 74°, N. lat. 47° 35'.

**QUEEN**, a woman who holds a crown singly.

The title of queen is also given by way of courtesy to her that is married to a king, who is called by way of distinction queen-consort; the former being termed queen-regent. The widow of a king is also called queen, but with the addition of dowager.

**QUEEN'S COUNTY**, a county of Ireland, bounded by King's-county, on the north; by Kildare, on the east; by Kilkenny, on the south; and by the province of Munster, on the west.

**QUEEN'S FERRY**, a town of Scotland, on the south side of the river Forth, ten miles west of Edinburgh.

**QUEENBOROUGH**, a borough town of the isle of Sheppy, in Kent, twelve miles north-west of Canterbury. It sends two members to parliament.

**QUERCUS**, in botany, a genus of the monœcia polyandria class. The calix of the male has five segments; it has no corolla; and the stamina are from five to ten. The calix of the female is one entire, rough-leaf; it has no corolla; the styli are from two to five; and the seed is ovated. There are 14 species, only one of them, *viz.* the robur, or common oak, a native of Britain.

**QUERCY**, the south-east division of the province of Guienne, in France, have Limosin on the north, and Languedoc on the south.

**QUERIA**, in botany, a genus of the triandria trigynia class. The calix consists of five leaves; it has no corolla; and the capsule has one cell and one seed. There are two species, none of them natives of Britain.

**QUESTION**, in logic, a proposition proposed by way of interrogation. See **LOGIC**.

**QUESTOR**, in Roman antiquity, an officer who had the management of the public treasure.

The questorship was the first office any person could bear in the commonwealth, and gave a right to sit in the senate.

At first there were only two; but afterwards two others were created, to take care of the payment of the armies abroad, of the selling plunder, booty, &c. for which purpose they generally accompanied the consuls in their expeditions: on which account they were called peregrini, as the first and principal two were called urbani.

The number of questors was afterwards greatly increased. They had the keeping of the decrees of the senate; and hence came the two offices of questor principis, or augustinus, sometimes called candidatus principis, whose office resembled in most respects that of our secretaries of state; and the questor palatii, answering in a great measure to our lord chancellor.

**QUEUE**, in heraldry, signifies the tail of a beast: thus if a lion be borne with a forked tail, he is blazoned double queued.

**QUICK**, or **QUICKSET HEDGE**, among gardeners, denotes all live hedges of whatever sort of plants they are composed, to distinguish them from dead hedges: but in a

more strict sense of the word, it is restrained to those planted with the hawthorn, under which name these young plants, or sets, are sold by the nursery-gardeners who raise them for sale.

**QUICKSILVER.** See **CHEMISTRY**, p. 85.

**QUIETISTS**, a religious sect, which made a great noise towards the close of the last century.

They were so called from a kind of absolute rest and inaction, which they supposed the soul to be in when arrived at that state of perfection which they called the unitive life; in which state, they imagined the soul wholly employed in contemplating its God, to whose influence it was entirely submissive, so that he could turn and drive it where and how he would. In this state, the soul no longer needs prayers, hymns, &c. being laid, as it were, in the bosom, and between the arms of its God, in whom it is in a manner swallowed up.

The Mahometans seem to be no strangers to quietism. They expound a passage in the seventieth chapter of the Koran, viz. *O thou soul, which art at rest, return unto thy Lord*, &c. of a soul, which having, by pursuing the concatenation of natural causes, raised itself to the knowledge of that Being which produced them, and exists of necessity, rests fully contented, and acquiesces in the knowledge, &c. of him, and in the contemplation of his perfections.

**QUILLS**, the large feathers taken out of the end of the wing of a goose, crow, &c.

Quills are denominated from the order in which they are fixed in the wing, the second and third quills being the best for writing, as they have the largest and roundest barrels.

In order to harden a quill that is soft, thrust the barrel into hot ashes, stirring it till it is soft; then taking it out, press it almost flat upon your knee with the back of a penknife, and afterwards reduce it to a roundness with your fingers. If you have a number to harden, set water and alum over the fire; and while it is boiling put in a handful of quills, the barrels only, for a minute, and then lay them by.

**QUINCE**, in botany. See **PYRUS**.

**QUINCUNX**, in Roman antiquity, denotes any thing that consists of five twelfth-parts of another, but particularly of the as.

**QUINDECAGON**, in geometry, a plain figure with fifteen sides and fifteen angles.

**QUINDECENVIRI**, in Roman antiquity, a college of 15 magistrates, whose business it was to preside over the sacrifices.

They were also the interpreters of the Sibyl's books; which, however, they never consulted but by an express order of the senate.

**QUINQUAGENARIUS**, in Roman antiquity, an officer who had the command of fifty men.

**QUINQUAGESIMA SUNDAY**, Shrove Sunday, so cal-

led as being about the fiftieth day before Easter.

**QUINQUATRIA**, in Roman antiquity, festivals celebrated in honour of Minerva, with much the same ceremonies as the panathenza were at Athens.

**QUINQUEFOLIUM**, in botany. See **PARENTILLA**.

**QUINQUENNALIS**, in Roman antiquity, a magistrate in the colonies and municipal cities of that empire, who had much the same office as the ædile at Rome.

**QUINQUEREMIS**, in antiquity, a galley with five rows of oars.

**QUINQUEVIRI**, in Roman antiquity, an order of five priests, peculiarly appointed for the sacrifices to the dead, or celebrating the rites of Erebus.

**QUINQUINA**. See **CINCHONA**.

**QUINTESSENCE**, in chemistry, a preparation consisting of the essential oil of some vegetable substance mixed and incorporated with spirit of wine.

**QUINTESSENCE**, in alchemy, is a mysterious term, signifying the fifth, or last and highest essence of power or a natural body.

**QUINTILE**, in astronomy, an aspect of the planets, when they are 72 degrees distant from one another, or a fifth part of the zodiac.

**QUINTILIANS**, a sect of ancient heretics, thus called from their prophets Quintilia. In this sect the women were admitted to perform the sacerdotal and episcopal functions. They attributed extraordinary gifts to Eve for having first eaten of the tree of knowledge; told great things of Miriam the sister of Moses, as having been a prophetess, &c. They added that Philip the deacon had four daughters who were all prophetesses, and were of their sect. In these assemblies it was usual to see the virgins entering in white robes, personating prophetesses.

**QUINZY**, **QUINSEY**, or **ANGLINA**. See **MEDICINE**, p. 84.

**QUIRE** of paper, the quantity of 24 or 25 sheets.

**QUIRINALIA**, in antiquity, a feast celebrated among the Romans in honour of Romulus, who was called Quirinus. These feasts were held on the 13th of the kalends of March.

**QUIRITES**, in antiquity, a name given to the people of Rome, chiefly the common citizens, as distinguished from the soldiery.

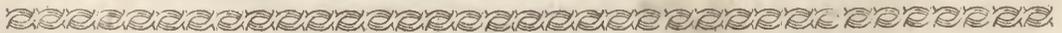
**QUOIN**, or **COIN**, on board a ship, a wedge fastened on the deck close to the breech of the carriage of a gun, to keep it firm up to the ship-side.

Cantic quoins are short three-legged quoins put between casks to keep them steady.

**QUOINS**, in architecture, denote the corners of brick or stone walls. The word is particularly used for the stones in the corners of brick-buildings. When these stand out beyond the brick-work, their edges being chamfered off, they are called rustic quoins.

**QUOTIDIAN**, in medicine. See **MEDICINE**, p. 62.

**QUOTIENT**, in arithmetic. See **ARITHMETIC**, p. 376.



R.

R A B

**R A A B**, a city of Lower Hungary, situated at the confluence of the rivers Danube and Raab, and subject

R A B

to the house of Austria: E. long. 18°, N. lat. 48°. **R A B B I**, or **R A B B I N S**, a title which the pharisees and doctors

tors of the law among the Jews assumed, and literally signifies masters, or excellents.

There were several gradations before they arrived at the dignity of a rabbin, which was not conferred till they had acquired the profoundest knowledge of the law and the traditions. It does not however appear, that there was any fixed age, or previous examination necessary; but when a man had distinguished himself by his skill in the written and oral law, and passed through the subordinate degrees, he was saluted a rabbin by the public voice.

Among the modern Jews, for near seven hundred years past, the learned men retain no other title than that of rabbi, or rabbins; they have great respect paid them, have the first places or seats in their synagogues, determine all matters of controvery, and frequently pronounce upon civil affairs; they have even a power to excommunicate the disobedient.

**RABBIT**, in zoology. See **LEPUS**.

**RACE**, in general, signifies running with others in order to obtain a prize, either on foot, or by riding on horseback, in chariots, &c.

**RACE**, in genealogy, a lineage or extraction continued from father to son.

**RACHITIS**, the **RICKETS**. See **MEDICINE**, p. 169.

**RACK**, an engine of torture, furnished with pullies and cords, &c. for extorting confession from criminals.

**RACK**, a spirituous liquor made by the Tartars of Tongusia. This kind of rack is made of mare's milk, which is left to be sour, and afterwards distilled twice or thrice between two earthen pots closely stopped, from whence the liquor runs through a small wooden pipe. This liquor is more intoxicating than brandy distilled from wine.

Rack is also a spirituous liquor which the English get from Batavia or Malacca, of which there are three sorts, the one being extracted from the cocoa-tree, the second from rice, and the third from sugar: but the first is the best and most in use. It is made of the blossom-bunch of the cocoa-tree: for which purpose they tie the bunch, while it is still wrapped up within its cod, or membrane, with a piece of packthread; and then with a knife make a cross cut in that bunch, a little above the place where it is tied, and adapt a pitcher to it to receive the liquor, which is called toddy, and is vinous, palatable, and sweet: others use a bamboe-cane instead of a pitcher. Having thus drawn the liquor, they let it ferment, and afterwards distil it.

To **RACK** wines, &c. to draw them off from their lees, after their having stood long enough to clear and settle.

Hence rack-vintage is frequently used for the second voyage our wine-merchants used to make into France for racked-wines.

**RACKOON**, in zoology. See **VIVERRA**.

**RADIALIS**, in anatomy. See **ANATOMY**, p. 198.

**RADIANT**, in optics, is any point of a visible object from whence rays proceed. See **OPTICS**.

**RADIATED FLOWERS**, in botany, are such as have several semi-flores set round a disk, in form of a radiant star; those which have no such rays are called discous flowers.

**RADIATION**, the act of a body emitting or diffusing rays of light all round, as from a centre. See **OPTICS**.

**RADICAL**, in general, something that serves as a basis or foundation.

Hence physicians talk much of a radical moisture.

In grammar, we give the appellation radical to primitive words, in contradistinction to compounds and derivatives.

Algebraists also speak of the radical sign of quantities, which is the character expressing their roots.

**RADICLE**, that part of the seeds of all plants, which upon vegetating becomes its root, and is discoverable by the microscope. See **AGRICULTURE**, p. 41.

**RADISH**, in botany. See **RAPHANUS**.

**RADIUS**, in geometry, the semi-diameter of a circle, or a right line drawn from the centre to the circumference.

**RADIUS**, in anatomy. See **ANATOMY**, p. 179.

**RADIX**. See **ROOT**.

**RADNOR**, the capital of the county of Radnor in Wales, situated in W. long. 3° 6', N. lat. 52° 20'.

**RAFTERS**, in building, are pieces of timber, which standing by pairs on the raifon or raising piece, meet in an angle at the top, and form the roof of a building. See **ARCHITECTURE**.

**RAGOUT**, a sauce, or seasoning, intended to rouse the appetite when lost or languishing.

**RAGULED**, or **RAGGED**, in heraldry, jagged or knotted. This term is applied to a cross formed of the trunks of two trees without their branches, of which they shew only the stumps. See **Plate CXLVII**. fig. 5.

Raguled differs from indented, in that the latter is regular, the former not.

**RAJA**, the title of the Indian black princes, the remains of those who ruled there before the Moguls. Some of the rajas are said to preserve their independency, especially in the mountainous parts; but most of them pay an annual tribute to the Mogul.

**RAJA**, in ichthyology, a genus belonging to the order of amphibia nantes. There are five spiracula below towards the peak; the body is compressed; and the mouth is situate under the head. There are nine species, one of which is the torpedo, or cramp-fish, found in the Mediterranean and Persian Gulph. When touched, it defends itself by a tremulous motion, which benumbs any animal which attempts to injure it.

**RAJANIA**, in botany, a genus of the diœcia hexandria class. The calix of both male and female consists of six segments; none of them have any corolla; the female has three styli; the fruit is roundish, with an oblique wing. There are three species, none of them natives of Britain.

**RAIL**, in ornithology. See **RALLUS**.

**RAIN**, water which descends from the clouds in form of drops of water.

Rain is apparently the precipitated vapours of watery clouds: thus, when various congeries of clouds are driven together by the agitation of the winds, they mix and run into one body, and by that means dissolve and condense each other into their former substance of water: also the coldness of the air is a great means to collect, compact, and condense clouds into water; which being heavier than the air, must of necessity fall through it in the form we call rain. Now the reason why it falls in drops and not in whole quantities, as it becomes condensed, is the resistance of the air; whereby being broken and divided into smaller and smaller parts the farther it passes through the air, it at last arrives to us in small drops.

Mr. Derham accounts for the precipitation hence, that the vesiculæ being full of air, when they meet with a colder air than that they contain, their air is contracted into a less space; and consequently the watery shell rendered thicker, so as to become heavier than the air, &c.

Others only allow the cold a part in the action, and bring in the winds as sharers with it: indeed, it is plain, that a wind, blowing against a cloud, will drive its vesiculæ upon one another, by which means several of them coalescing, will be enabled to descend; and the effect will be still more considerable if two opposite winds blow towards the same place. Add to this, that clouds already formed, happening to be aggravated by fresh accessions of vapour continually ascending, may thence be enabled to descend.

According to Rohault, the great cause of rain is the heat of the air; which, after continuing for some time near the earth, is at length carried up on high by a wind, and there thawing the snowy villi, or flocks of the half frozen vesiculæ, reduces them into drops; which, coalescing, descend.

Others, as Dr. Clarke, &c. ascribe this descent of the clouds rather to an alteration of the atmosphere than of the vesiculæ; and suppose it to arise from a diminution of the elastic force of the air. This elasticity, which depends chiefly or wholly on the terrene exhalations, being weakened, the atmosphere sinks under its burden, and the clouds fall.

Now the little vesicles, being once upon the descent, will persist therein, notwithstanding the increase of resistance they every moment meet with. For as they all tend toward the centre of the earth, the farther they fall, the more coalitions will they make; and the more coalitions, the more matter will there be under the same surface; the surface only increasing as the squares, but the solidity as the cubes; and the more matter under the same surface, the less resistance there will be to the same matter. Thus, if the cold, wind, &c. act early enough to precipitate the ascending vesicles, before they are arrived at any considerable height, the coalitions being but few, the drops will be proportionably small; and thus is formed a dew. If the vapours be more copious, and rise a little higher, we have a mist or fog. A little higher still, and they produce a small rain, &c. If they neither meet with cold nor wind, they form a heavy, thick, dark sky.

Hence, many of the phenomena of the weather may be accounted for: as, why a cold summer is always a wet one, and a warm a dry one; why we have commonly most rain about the equinoxes; why a settled, thick, close sky scarce ever rains, till it have been first clear. As to the quantity of rain that falls, its proportion in several places at the same time, and in the same place at several times, we have store of observations, journals, &c. in the memoirs of the French Academy, Philosophical Transactions, &c.

**RAIN-BOW.** See OPTICS, p. 435, &c.

**Lunar RAIN-BOW.** The moon sometimes also exhibits the phenomenon of an iris, by the refraction of her rays in drops of rain in the night-time.

Aristotle says, he was the first that ever observed it; and adds, that it is never visible but at the time of full moon.

The lunar iris has all the colours of the solar, only fainter.

**Marine RAIN-BOW,** the sea-bow, is a phenomenon sometimes observed in a much agitated sea, when the wind, sweeping part of the tops of the waves, carries them aloft; so that the rays of the sun are refracted, &c. as in a common shower.

**RAISINS,** grapes prepared by suffering them to remain on the vine till they are perfectly ripe, and then drying them in the sun, or by the heat of an oven. The difference between raisins dried in the sun, and those dried in ovens, is very obvious: the former are sweet and pleasant, but the latter have a latent acidity with the sweetness that renders them much less agreeable.

**RAKE of a ship** is all that part of her hull which hangs over both ends of her keel. That which is before, is called the fore-rake, or rake-forward; and that part which is at the setting on of the stern post, is called the rake aft, or afterward.

**RALLUS,** in ornithology. a genus belonging to the order of grallæ. The beak is thickest at the base, compressed, equal, acute, and somewhat sharp on the back near the point; the nostrils are oval; the feet have four toes, without any web; and the body is compressed. There are ten species, principally distinguished by their colour.

**RAM,** in zoology. See OVIS.

**RAM,** in astronomy. See ASTRONOMY.

**Battering RAM,** in antiquity, a military engine used to batter and beat down the walls of places besieged.

The battering ram was of two sorts; the one rude and plain, the other compound. The former seems to have been no more than a great beam which the soldiers bore on their arms and shoulders, and with one end of it by main force assailed the wall. The compound ram is thus described by Josephus; it is a vault beam, like the mast of a ship, strengthened at one end with a head of iron, something resembling that of a ram, whence it took its name.

This was hung by the middle with ropes to another beam, which lay across two posts; and hanging thus equally balanced, it was by a great number of men drawn backwards and pushed forwards, striking the wall with its iron-head.

Plutarch informs us, that Marc Anthony, in the Parthian war, made use of a ram fourscore feet long; and Vitruvius tells us, that they were sometimes an hundred and six, and sometimes an hundred and twenty feet in length; and to this perhaps the force and strength of the engine was in a great measure owing. The ram was managed at one time by a whole century of soldiers; and they being spent, were succeeded by another century, so that it played continually without any intermission.

**RAM'S HEAD,** in a ship, is a great block belonging to the fore and main-halliards. It has three flivers in it, into which the halliards are put, and in a hole at the end of it are reeved the ties.

**RAMADAN,** a solemn season of fasting among the Mahometans. See MAHOMETANISM.

**RAMIFICATION,** the production of boughs or branches, or of figures resembling branches.

**RAMMER,** an instrument used for driving down stones or piles into the ground; or for beating the earth, in order to render it more solid for a foundation.

**RAMMER of a gun,** the gun-stick; a rod used in charging of a gun, to drive home the powder, as also the shot and the

- the wad, which keeps the shot from rolling out. See GUNNERY.
- RAMPANT**, in heraldry, a term applied to a lion, leopard, or other beast that stands on his hind-legs, and rears up his forefeet in the posture of climbing, shewing only half his face, as one eye, &c. It is different from salient, in which the beast seems springing forward as if making a sally. See Plate CXLVII. fig. 6.
- RAMPART**, in fortification, is an elevation of earth round a place capable of resisting the cannon of an enemy; and formed into bastions, curtains, &c. See FORTIFICATION.
- RAMSEY**, an island in the Irish channel, on the coast of Pembrokehire: W. long  $5^{\circ} 20'$ , N. lat.  $51^{\circ} 55'$ .
- RAMUS**, in general, denotes a branch of any thing, as of a tree, an artery, vein, &c.
- RANA**, the FROG, in zoology, a genus belonging to the class of amphibia reptilia. The body is naked, furnished with four feet, and without any tail. There are 17 species. Frogs undergo a very strange metamorphosis. When they first issue from the eggs, they appear in a roundish form, with a long tail, and are then denominated tadpols. After continuing in this state for several weeks, the tail begins to mortify and fall off gradually, the feet at the same time springing as gradually out of the body, till they assume the complete form of frogs.
- RANCHIERA**, a port-town of Terra Firma, situated in W. long.  $72^{\circ}$ , N. lat.  $11^{\circ} 34'$ .
- RANCID**, denotes a fatty substance that is become rank or musky, or has contracted an ill smell by being kept close.
- RANGE**, in gunnery, the path of a bullet, or the line it describes from the mouth of the piece to the point where it lodges. See GUNNERY.
- RANGIFER**, the RAIN-DEER. See CORVUS.
- RANK**, the order or place allotted a person, suitable to his quality or merit.
- RANKING OF CREDITORS**, in Scots law. See LAW, Tit. xix. 13.
- RANSOM**, a sum of money paid for the redemption of a slave, or for the liberty of a prisoner of war. In our law-books, ransom is also used for a sum paid for the pardon of some great offence, and to obtain the offender's liberty.
- RANULA**, a tumour under the tongue, which like a ligature hinders a child from speaking or sucking.
- RANUNCULUS**, in botany, a genus of the polyandria polygynia class. The calix consists of five leaves, and the corolla of five petals, with a melliferous pore in the claw of each; and the seeds are naked. There are 38 species, 11 of them natives of Britain.
- RAOLCONDA**, a city of the hither India, situated in the province of G. lconda: E. long.  $79^{\circ}$ , N. lat.  $17^{\circ} 12'$ .
- RAPACIOUS ANIMALS**, are such as live upon prey.
- RAPE**, in law, the having carnal knowledge of a woman by force and against her will. See LAW, Tit. xxxiii. 26.
- RAPHANUS**, in botany, a genus of the tetradynamia siliquosa class. The calix is shut; the pod is cylindrical, and subarticulated; there are two melliferous glands between the short stamina and the pistillum, and as many between the long stamina and calix. There are three species, only one of them, viz. the raphanistrum, charlock, a native of Britain.
- RAPHIDIA**, in zoology, a genus of insects belonging to the order of neuroptera. The head is depressed and horny; it has two teeth, four pappi, and three stemmata; the wings are deflected; the feelers are cylindrical, and of the length of the thorax; and the tail of the female is furnished with a lax bended bristle. There are three species.
- RAPIER**, formerly signified a long old-fashioned broad sword, such as those worn by the common soldiers: but it now denotes a small sword, as contradicting distinguished from a back-sword.
- RAPINE**, in law, the taking away another's goods, &c. openly and by violence.
- RAPPAHANOCK**, a large navigable river which rises in the mountains west of Virginia, and discharges itself into the bay of Chesapeake.
- RAPTURE**, an ecstacy, or transport of mind. See ECSTASY.
- RARE**, in physics, stands opposed to dense; and denotes a body that is very porous, whose parts are at a great distance from one another, and which contains but little matter under a large bulk.
- RAREFACTION**, in physics, the act whereby a body is rendered rare; that is, brought to possess more room, or appear under a larger bulk without accession of any new matter.
- RASEBURG**, a port town of Sweden, in the province of Finland, and territory of Nyland, situated on the gulph of Finland: E. long.  $23^{\circ}$ , N. lat.  $60^{\circ} 22'$ .
- RASTAT**, the name of two towns of Germany; one in the circle of Bavaria and archbishopric of Saltzburg, situated on the river Ens, thirty-five miles south of the city Ens; another in the circle of Swabia and marquisate of Baden, situated on the east side of the river Rhine, twenty-one miles south-west of Philippsburg.
- RAT**, in zoology. See MUS.
- RAT-TAILS**, or **ARRESTS**, in the manege, signify hard callous swellings upon the hinder legs under the hough, running along the sinew.  
A horse is called rat-tail, when he has no hair upon his tail.
- RATAFIA**, a fine spirituous liquor, prepared from the kernels, &c. of several kinds of fruits, particularly of cherries and apricots.  
Ratafia of cherries is prepared by bruising the cherries, and putting them into a vessel wherein brandy has been long kept; then adding to them the kernels of cherries, with straw-berries, sugar, cinnamon, white pepper, nutmeg, cloves; and to twenty pound of cherries, ten quarts of brandy. The vessel is left open ten or twelve days, and then stopped close for two months before it be tapped. Ratafia of apricots is prepared two ways, viz. either by boiling the apricots in white wine, adding to the liquor an equal quantity of brandy, with sugar, cinnamon, mace, and the kernels of apricots; infusing the whole for eight or ten days, then straining the liquor, and putting it up for use: Or else by infusing the apricots cut in pieces in brandy, for a day or two, passing it through a straining bag, and then putting in the usual ingredients.
- RATCH**, or **RASH**, in clock-work, a sort of wheel having twelve fangs, which serve to lift up the detents every hour, and make the clock strike. See WATCH.
- RATCHETS**, in a watch, are the small teeth at the bot-

- tom of the fuly, or barrel, which stops it in winding up.
- RATE**, a standard or proportion, by which either the quantity or value of a thing is adjusted.
- RATE** of a *ship of war*, is its order, degree, or distinction, as to magnitude, burden, &c.
- RATEEN**, in commerce, a thick woollen stuff, quilted, woven on a loom with four treddles, like serges, and other stuffs, that have the whale or quilling. There are some rateens dressed and prepared like cloths; others left simply in the hair; and others where the hair or knap is friz'd. Rateens are chiefly manufactured in France, Holland, and Italy, and are mostly used in linings. The frize is a sort of coarse rateen, and the drug-get is a rateen half linnen half woollen.
- RATIFICATION**, an act approving off, and confirming something done by another in our name.
- RATIO**, in arithmetic and geometry, is that relation of homogeneous things which determines the quantity of one from the quantity of another, without the intervention of a third. See **ARITHMETICK**, **ALGEBRA**, and **GEOMETRY**.
- RATIOCINATION**, the act of reasoning. See **REASONING**.
- RATION**, in the army, a portion of ammunition, bread, drink, and forage, distributed to each soldier in the army, for his daily subsistence, &c. The horse have rations of hay and oats, when they cannot go out to forage. The rations of bread are regulated by weight. The ordinary ration of a foot-soldier is a pound and a half of bread per day. The officers have several rations according to their quality and the number of attendants that they are obliged to keep. When the ration is augmented on occasions of rejoicing, it is called a double ration. The ships crews have also their rations or allowances of biscuit, pulse, and water, proportioned according to their stock.
- RATIONAL**, *reasonable*. See **REASON**.
- RATIONAL**, is also applied to integral, fractional, and mixt numbers: thus we say rational fraction, rational integer, and rational mixt number.
- RATIONALE**, a solution or account of the principles of some opinion, action, hypothesis, phenomenon, or the like.
- RATIPOR**, a town of Bohemia, in the duchy of Silesia, situated on the river Oder, sixteen miles north-east of Tröppaw.
- RATIPOR**, is also a city of hither India, capital of the province of Malva, situated E. long 80°, N. lat 25°.
- RATISBON**, a city of Germany, in the circle of Bavaria, situated at the confluence of the rivers Danube and Regen, in E. long. 12° 5', N. lat. 49°. This is a free imperial city, and here the assembly or diet of the states of the empire meets.
- RATLINES** or, as the seamen call them, **RATLINS**, those lines which make the ladder steps to go up the shrouds and buttocks, hence called the ratlins of the shrouds.
- RATTLE SNAKE**. See **CROTALUS**.
- RATTLE SNAKE ROOT**. See **POLYCALA**.
- RAVA**, a city of Great Poland, capital of the Palatinate of Rava, situated fifty miles south east of Warsaw.
- RAVELIN**, in fortification, was anciently a flat bastion, placed in the middle of a curtain; but now a detached work composed only of two faces, which make a salient
- angle, without any flanks, and raised before the curtain on the counterscarp of the place. See **FORTIFICATION**.
- RAVEN**, in ornithology. See **COCCYUS**.
- RAVENGLAS**, a port-town of Cumberland, situated on the Irish Channel, thirty-eight miles south-west of Carlisle.
- RAVENNA**, a city of Italy, in the pope's territories, capital of the province of Romania, situated E. lon. 13°, N. lat. 44° 30'.
- RAUVOLFIA**, in botany, a genus of the pentagrdia monogynia class. The berry contains two seeds. There are two species; both natives of America.
- RAY**, in optics, a beam of light, emitted from a radiant or luminous body. See **OPTICS**.
- RAYLEIGH**, a market-town of Essex, ten miles south-east of Chelmsford.
- RAYONANT**, or *Cross* **RAYONANT**, in heraldry, one which has rays of glory behind it, darting out from the centre to all the quarters of the escutcheon, as represented in Plate CXLVII. fig. 7.
- RAZOR**, a well known instrument used by surgeons, barbers, &c. for shaving off the hair from various parts of the body.
- RAZOR-BILL**, in ornithology. See **ALCA**.
- RE-ACTION**, in physiology, the resistance made by all bodies to the action or impulse of others, that endeavour to change its state whether of motion or rest. See **MECHANICS**.
- READING**, a borough town in Berkshire, situated forty miles west of London, near the confluence of the river Kenet and Thames; it sends two members to parliament.
- REAL**, is applied to a being that actually exists; in which sense, it coincides with actual.
- REAL**, or **CHIAPA**, a city of Mexico, in North America, capital of the province of Chiapa, situated W. lon. 95°, N. lat. 17°.
- REALEJO** a port-town of Mexico, in the province of Nicaragua, situated on the bay of the Pacific Ocean, in W. long. 91° 30', N. lat 12°.
- REALISTS**, a sect of school philosophers, formed in opposition to the nominalists. See **NOMINALISTS**.
- Under the Realists are included the Scotists, Thomists, and all, excepting the followers of Ockam. Their distinguishing tenet is, that universals are realities, and have an actual existence out of an idea or imagination, or, as they express it in the schools, *a parte rei*; whereas the nominalist contend, that they exist only in the mind; and are only ideas, or manners of conceiving things.
- REALITY**, in the schools, a diminutive of *res*, thing, first used by the Scotists, to denote a thing which may exist of itself; or which has a full and absolute being of itself, and is not considered as a part of any other.
- REALM** a country which gives its head, or governor, the denomination of a king.
- REALMONT**, a town of France, in the province of Languedoc, situated thirty-two miles north-east of Thoulouse.
- REAR**, a term frequently used in composition, to denote something behind or backwards, in respect of another, in opposition to *van*: thus, in a military sense, it is used for the hind part of an army, in opposition to the front.
- REASON**, a faculty or power of the mind, whereby it distin-

- distinguishes good from evil, truth from falsehood, &c. See LOGIC and METAPHYSICS.
- REASONING, RATIOCINATION**, the exercise of the faculty of the mind called reason; or it is an act or operation of the mind, deducing some unknown proposition from other previous ones that are evident and known. See LOGIC, and METAPHYSICS.
- REBATE, or REBATEMENT**, in commerce, a term much used at Amsterdam, for an abatement in the price of several commodities, when the buyer instead of taking time advances ready money.
- REBATEMENT**, in heraldry, a diminution or abatement of the bearings in a coat of arms.
- REBEL**, a town of Germany, in the duchy of Mecklenburgh, thirty-two miles south-east of Gultrow.
- REBELLION**, a traiterous taking up of arms against the king by his own natural subjects, or those formerly subdued.
- REBUS**, in ænigmatical representation of some name, &c. by using figures or pictures instead of words, or parts of words. Camden mentions an instance of this absurd kind of wit in a gallant, who expressed his love to a woman, named Rose Hill, by painting in the border of his gown a *rose, a hill, an eye, a loaf, and a well*; which, in the style of the rebus, reads, *Rose Hill, I love well*. This kind of wit was long practised by the great, who took the pains to find devices for their names. It was however, happily ridiculed by Ben Johnson, in the humorous description of Abel Druggers device; in the Alchemist; and by the Spectator, in the device of lack of Newberry; at which time the rebus, being raised to sign-posts, was grown out of fashion at court.
- REBUTTER**, in law, the defendant's answer to the plaintiff's rejoinder, in a cause depending in the court of chancery, &c.
- RECAPITULATION**, is a summary, or a concise and transient enumeration of the principal things insisted on in the preceding discourse, whereby the force of the whole is collected into one view.
- RECEIVER**, in pneumatics, a glass vessel for containing the thing on which an experiment in the air-pump is to be made. See PNEUMATICS.
- RECEPTACULUM**, See ANATOMY, p. 282.
- RECHABITES**, a kind of religious order among the ancient Jews, instituted by Joadab the son of Rechab, comprehending only his own family and posterity. Their founder prescribed them three things: first, not to drink any wine; secondly, not to build any houses, but to dwell in tents; and thirdly, not to sow any corn, or plant vines. These rules the Rechabites observed with great strictness.
- RECIPE**, in medicine, a prescription or remedy, to be taken by a patient; so called because always beginning with the word *recipe*, i. e. *take*; which is generally denoted by the abbreviation R.
- RECIPIENT**, the same with receiver.
- RECIPROCAL**, in general, something that is mutual, or which is returned equally on both sides, or that affects both parties alike.
- RECIPROCAL TERMS**, among logicians, are those which have the same signification; and consequently are convertible, or may be used for each other.
- RECIPROCAL FIGURES**, in geometry, those which have the antecedents and consequents of the same ratio in both figures. See GEOMETRY.
- RECHTATIVO**; in music, a kind of singing that differs but little from ordinary pronunciation, such as that in which the several parts of the liturgy are rehearsed in cathedrals; or that wherein the actors commonly deliver themselves on the theatre at the opera, when they are to express some action or passion, to relate some event, or reveal some design.
- RECKONING, or a ship's RECKONING**. See NAVIGATION.
- RECLINATION** of a plane, in dialling, the number of degrees which a dial-plane leans backwards from an exactly upright or vertical plane, that is, from the zenith. See DIALLING.
- RECLUSE**, among the Papists, a person shut up in a small cell of an hermitage, or monastery, and cut off, not only from all conversation with the world, but even with the house. This is a kind of voluntary imprisonment, from a motive either of devotion or penance.
- RECOLLECTION**, a mode of thinking, by which ideas sought after by the mind, are found, and brought again to view.
- RECONNOITRE**, in war, to view and examine the state and situation of things.
- RECORD**, an authentic testimony in writing, contained in rolls of parchment, and preserved in a court of record.
- RECORDER**, a person whom the mayor and other magistrates of a city or corporation associate to them, for their better direction in matters of justice, and proceedings in law; on which account this person is generally a counsellor, or other person well skilled in the law.
- The recorder of London is chosen by the lord mayor and aldermen; and, as he is held to be the mouth of the city, he delivers the judgment of the courts therein, and records and certifies the city-customs.
- RECOURSE ON BILLS**, in Scots law. See LAW, TITLE XXI. 12.
- RECUREMENT** in chemistry, some superfluous matter separated from some other that is useful; in which sense it is the same with scoria, fæces, and excrements. See CHEMISTRY.
- RECRIMINATION**, in law, an accusation brought by the accused against the accuser upon the same fact.
- RECRUITS**, in military affairs, new-raised soldiers, designed to supply the place of those who have lost their lives in the service, or are disabled by age or wounds.
- RECTANGLE**, in geometry, the same with a right-angled parallel gram. See GEOMETRY.
- RECTIFICATION**, in chemistry, is nothing but the repetition of a distillation or sublimation several times, in order to render the substance purer, finer, and freer from aqueous or earthy parts.
- RECTIFIER**, in navigation, an instrument consisting of two parts, which are two circles either laid one upon or set into, the other, and so fastened together in their centres, that they represent two compasses, one fixed, the other moveable; each of them divided into the thirty-two points of the compass, and three hundred and sixty degrees, and numbered both ways, from the north and the south, ending at the east and west in ninety degrees.
- The fixed compass represents the horizon, in which

the north and all the other points of the compass are fixed and immovable.

The moveable compass represents the mariners compass, in which the north and all other points are liable to variation.

In the centre of the moveable compass is fastened a silk thread, long enough to reach the outside of the fixed compass. But, if the instrument be made of wood, there is an index instead of the thread.

Its use is to find the variation of the compass, to rectify the course at sea; having the amplitude or azimuth given.

**RECTIFIER**, in the distillery, the person whose employment it is to take the coarse malt-spirit of the malt-stiller, and redistil it to a finer and better liquor.

**RECTILINEAR**, in geometry, right-lined: thus figures whose perimeter consists of right lines, are said to be rectilinear.

**RECTITUDE**, in philosophy, refers either to the act of judging or of willing: and therefore whatever comes under the denomination of rectitude is either what is true, or what is good; these being the only objects about which the mind exercises its two faculties of judging and willing.

Moral rectitude, or uprightness, is the chusing and pursuing those things which the mind, upon due inquiry and attention, clearly perceives to be good; and avoiding those that are evil.

**RECTOR**, a term applied to several persons whose offices are very different: as, 1. The rector of a parish is a clergyman that has the charge and cure of a parish, and possesses all the tithes, &c. 2. The same name is also given to the chief elective officer in several foreign universities, particularly in that of Paris. 3. Rector is also used in several convents for the superior officer who governs the house: and the Jesuits give this name to the superiors of such of their houses as are either seminaries or colleges.

**RECTORY**, a parish-church, parsonage, or spiritual living, with all its rights, tithes, and glebes.

**RECTUM**, in anatomy, the third and last of the large intestines or guts. See **ANATOMY**, p. 261.

**RECTUS**, in anatomy a name common to several pair of muscles, so called on account of the straightness of their fibres. See **ANATOMY**, Part II.

**RECURRENENTS**, in anatomy, a name given to several large branches of nerves sent out by the par vagum from the upper part of the thorax to the larynx.

**RECURVIROSTRA**, in ornithology, a genus belonging to the order of grallæ. The beak is subulated, bent back, sharp and flexible at the point; the feet are webbed, and furnished with three toes. There is but one species, *viz.* the avocetta, a native of the southern parts of Europe. It migrates into Italy, but seldom to the north.

**RECUSANTS**, such persons as acknowledge the pope to be the supreme head of the church, and refuse to acknowledge the king's supremacy; who are hence called popish recusants. These are in England charged with double taxes, not merely as Romanists but as recusants.

**RED**, one of the simple or primary colours of natural bodies, or rather of the rays of light. See **OPTICS**.

**RED**, in dying, is one of the five simple or mother colours. Some reckon six kinds or casts of red, *viz.* scarlet red,

crimson red, madder red, half-grain red, lively orange red, and scarlet of cochineal: but they may be all reduced to the three following, according to the three principal drugs which give the colours, *viz.* the kermes, cochineal, and madder.

**RED**, in heraldry. See **GULES**.

**RED RUSSIA**, or **LITTLE RUSSIA**, a province of Poland, bounded by the province of Polesia, on the north; by Volhinia and Podolia on the east; by the Carpathian mountains, which divide it from Transilvania and Hungary, on the south; and by the province of Little Poland, on the west; being two hundred miles long, and one hundred broad.

**RED-SEA** separates Asia from Africa.

**REDDLE**, a sof, heavy, red marle, of great use in colouring; and being washed and freed from its sand, is often sold by our druggists under the name of bole-armenic.

**REDEMPTION**, in law, a faculty or right of re-entering upon lands, &c. that have been sold and assigned, upon reimbursing the purchase-money with legal costs.

**REDENS**, in fortification, a kind of work indented in form of the teeth of a saw, with salient and re-entering angles, to the end that one part may flank or defend another. It is called saw-work and indented-work.

**REDINTEGRATION**, in the civil law, the act of restoring a person to the enjoyment of a thing whereof he had been illegally dispossessed.

**REDOUBT**, in fortification, a small square fort, without any defence but in front, used in trenches, lines of circumvallation, contravallation, and approach; as also for the lodgings of corps de gard, and to defend passages.

**REDRESSING**, the rectifying or setting any thing straight again.

In a moral sense, to redress grievances is to reform and remove them.

To redress a stag, among hunters, is to put him off his changes.

**REDRUTH**, a market-town of Cornwall, situated fifty miles south-west of Launceston.

**REDUBBORS**, those who buy stolen cloaths, &c. and, to the end they may not be known, convert them into some other form, or change the colour, &c.

**REDUCTION**, in the schools, a manner of bringing a term or proposition, which was before opposite to some other, to be equivalent to it.

**REDUCTION**, in arithmetick. See **ARITHMETICK**, p. 380.

**REDUCTION**, in surgery, denotes an operation whereby a dislocated, luxated, or fractured bone is restored to its former state or place.

**REDUCTION**, in Scots law. See **LAW**, Tit. xxx. 3.

**REDUNDANCY**, a fault in discourse, consisting in the use of a superfluity of words. Words perfectly synonymous are redundant, and ought to be retrenched.

**REED**, in botany. See **ARUNDO**.

**REEF**, a term in navigation. When there is a great gale of wind, they commonly roll up part of the sail below, that by this means it may become the narrower, and not draw so much wind; which contracting or taking up the sail, they call a reef, or reefing the sail: so also when a top-mast is sprung, as they call it, that is, when it is cracked, or almost broken in the cap, they cut off the lower piece that was near broken off, and setting the other part,

part, now much shorter, in the step again, they call it a reefed top-mast.

**REEL**, in the manufactories, a machine serving for the office of reeling. There are various kinds of reels, some very simple, others very complex.

**REELING**, in the manufactories, the winding of thread, silk, cotton, or the like, into a skein, or upon a bottom, to prevent its entangling. It is also used for the charging or discharging of bobbins or quills, to use them in the manufacture of different stuffs, as thread, silk, cotton, &c. Reeling is performed different ways, and on different engines.

**REEVING**, in the sea language, the putting a rope through a block: hence to pull a rope out of a block, is called unreeving.

**RE-EXCHANGE**, in commerce, a second payment of the price of exchange, or rather the price of a new exchange due upon a bill of exchange that comes to be protested and to be refunded the bearer by the drawer or indorser.

**REFECTION**, among ecclesiastics, a spare meal or repast, just sufficing for the support of life: hence the hall in convents, and other communities, where the monks, nuns, &c. take their refectons or meals in common, is called the refectory.

**REFERENCE**, in writing, &c. a mark relative to another similar one in the margin, or at the bottom of the page, where something omitted in the text is added, and which is to be inserted either in reading or copying.

**REFINING**, in general, is the art of purifying a thing; including not only the assaying or refining of metals, but likewise the clarification of liquors.

**REFINING of gold.** See **CHEMISTRY**, p. 129.

**REFINING of silver.** See **CHEMISTRY**, p. 130.

**REFLECTION**, the return or regressive motion of a moving body, occasioned by some obstacle which hindered it from pursuing its former direction.

**REFLECTION of the rays of light.** See **OPTICS**.

**REFLECTION** is also used, figuratively, for an operation of the mind; whereby it turns its view backwards as it were upon itself, and makes itself and its own operation the object of its disquisition; and by contemplating the manner, order, and laws which it observes in perceiving ideas, comparing them together, reasoning, &c. it frames new ideas of the relations discovered therein. See **LOGIC**, and **METAPHYSICS**.

**REFLUX of the sea**, the ebbing of the water, or its returning from the shore. See **ASTRONOMY**, p. 473.

**REFORMATION**, the act of reforming or correcting an error or abuse in religion, discipline, or the like.

The Reformation, so called by way of eminence, is the separation of the Protestants from the church of Rome, in the beginning and towards the middle of the sixteenth century.

**REFRACTION**, in general, is the deviation of a moving body from its direct course, occasioned by the different density of the medium it moves in; or, it is a change of direction, occasioned by a body's falling obliquely out of one medium into another of a different density. See **OPTICS**.

**REFRANGIBILITY of light**, the disposition of rays to be refracted. See **OPTICS**.

**REFRIGERATIVE**, in medicine, a remedy which re-

freshes the inward parts, by cooling them, as clysters, pitans, &c.

**REFRIGERATORY**, in chemistry a vessel filled with cold water, through which the worm passes in distillations; the use of which is, to condense the vapours as they pass through the worm.

**REFUGE**, a sanctuary or asylum.

**REFUGEES**, French Protestants; who, by the revocation of the edict of Nantz, have been constrained to fly from persecution, and take refuge in foreign countries.

**REGAL or ROYAL**, something belonging to a king.

**REGALE**, a magnificent entertainment or treat given to ambassadors, and other persons of distinction, to entertain or do them honour.

It is usual, in Italy, at the arrival of a traveller of eminence, to send him a regale, that is, a present of sweetmeats, fruit, &c. by way of refreshment.

**REGALE**, in the French jurisprudence, is a royal prerogative, which consists in enjoying the revenues of bishoprics during the vacancy of their sees, of presenting to benefices, and of obliging the new bishop to take an oath of fidelity, and to register it in the chamber of accounts. The enjoyment of the fruits of the see is called the temporal regale; and that of presenting to the see, the spiritual regale.

**REGALIA**, in law, the rights and prerogatives of a king; which, according to civilians, are six: *viz.* 1. The power of judicature: 2. The power of life and death: 3. The power of peace and war: 4. A right to such goods as have no owner, as waifs, estrays, &c. 5. Assessments: and, 6. The coinage of money.

Regalia is also used for the apparatus of a coronation, as the crown, the sceptre with the cross, that with the dove, St. Edward's staff, the globe, and the orb with the cross, four several swords, &c.

**REGALIA**, in Scots law. See **LAW**, Tit. xiii. 3.

**Lord of REGALITY**, in Scots law. See **LAW**, Tit. iv. 4.

**REGARDANT**, in heraldry, signifies looking behind; and is used for a lion, or other beast, with his face turned towards his tail.

**REGARDER**, an ancient officer of the king's forest, sworn to make the regard of the forest every year; that is, to take a view of its limits, to inquire into all offences and defaults committed by the foresters within the forest, and to observe whether all the other officers executed their respective duties.

**REGEL**, or **RIGEL**, a fixed star of the first magnitude, in Orion's left foot.

**REGENERATION**, in theology, the act of being born again by a spiritual birth, or the change of heart and life experienced by a person who forsakes a course of vice, and sincerely embraces a life of virtue and piety.

**REGENT**, one who governs a kingdom during the minority or absence of the king.

In France, the queen mother has the regency of the kingdom during the minority of the king, under the title of queen-regent.

**REGENT** also signifies a professor of arts and sciences in a college, who has a set of pupils under his care; but here regent is generally restrained to the lower classes, as regent of rhetoric, regent of logic, &c. those of philosophy are rather called professors.

**REGICIDE**, KING-KILLER, a word chiefly used with us in speaking of the persons concerned in the trial, condemnation, and execution of king Charles I.

**REGIFUGE**, a feast celebrated in ancient Rome on the sixth of the kalends of March, in memory of the expulsion of their ancient kings, and particularly of Tarquin's flying out of Rome on that day.

**REGIMEN**, the regulation of diet, and, in a more general sense, of all the non-naturals, with a view to preserve or restore health. See **MEDICINE**.

**REGIMEN**, in grammar, that part of syntax, or construction, which regulates the dependency of words, and the alterations which one occasions in another. See **GRAMMAR**.

**REGIMENT**, in war, is a body of men, either horse or foot, commanded by a colonel.

Each regiment of foot is divided into companies; but the number of companies is not always alike; though our regiments generally consist of thirteen companies, one of which is always grenadiers.

Regiments of horse most commonly consist of six troops, but some have nine.

Regiments of dragoons, in time of war, are generally composed of eight troops; and in time of peace, of six.

**REGION**, in geography, a large extent of land, inhabited by many people of the same nation, and inclosed within certain limits or bounds.

**REGISTER**, a public book in which is entered and recorded memoirs, acts, and minutes, to be had recourse to occasionally, for knowing and proving matters of fact.

**REGISTER SHIPS**, in commerce, are vessels which obtain a permission either from the king of Spain, or the council of the Indies, to traffic in the ports of the Spanish West-Indies; which are thus called, from their being registered before they set sail from Cadiz, for Buenos Ayres.

**REGISTERS**, in chemistry, are holes, or chinks with stopples, contrived in the sides of furnaces, to regulate the fire; that is, to make the heat more intense, or remiss, by opening them to let in the air, or keeping them close to exclude it.

**REGISTRY**, the office, books, and rolls, in which the proceedings in chancery, or any spiritual court, are registered.

**REGRATOR**, or **REGRATER**, in law, formerly signified one who bought wholesale, or by the great, and sold again by retail: but the term is now used for one who buys any wares or victuals, and sells them again in the same market, or fair, or within fifteen miles round it. See **FORSTALLING**.

**REGULAR**, denotes any thing that is agreeable to the rules of art: thus, we say a regular building, verb, &c.

A regular figure, in geometry, is one whose sides, and consequently angles, are equal; and a regular figure with three or four sides, is commonly termed an equilateral triangle, or square; as all others with more sides are called regular polygons.

**REGULAR**, in a monastery, a person who has taken the vows; because he is bound to observe the rules of the order he has embraced.

**REGULATION**, a rule or order prescribed by a superior, for the proper management of some affair.

**REGULATOR** of a watch, the small spring belonging to

the balance; serving to adjust its motions, and make it go faster or slower. See **WATCH**.

**REGULUS**, in ornithology. See **MOTACILLA**.

**REGULUS**, in chemistry, an imperfect metallic substance, that falls to the bottom of the crucible, in the melting of ores or impure metallic substances. See **CHEMISTRY**, *passim*.

**REHABILITATION**, in the civil and the canon law; the restoring a delinquent to his former condition.

**REHEARSAL**, in music and the drama, an essay or experiment of some composition, generally made in private, previous to its representation or performance in public, in order to render the actors and performers more perfect in their parts.

**REIN-DEER**, in zoology. See **CERVUS**.

**REINS**, in anatomy. See **ANATOMY**, p. 268.

**REJOINER**, in law, is the defendant's answer to the plaintiff's replication or reply. Thus, in the court of chancery, the defendant puts in an answer to the plaintiff's bill, which is sometimes also called an exception; the plaintiff's answer to this is called a replication; and the defendant's answer to that a rejoinder.

**REITERATION**, the act of repeating a thing, or doing it a second time.

**RELAPSE**, a falling again into a danger, evil, or disease, from which a person has escaped.

**RELATION**, the mutual respect of two things, or what each is with regard to the other. See **METAPHYSICS**.

**RELATION**, in geometry. See **RATIO**.

**RELATION** is also used for analogy. See **ANALOGY**.

**RELATIVE**, something relating to, or respecting, another.

**RELATIVE TERMS**, in logic, are words which imply a relation: such are master and servant, husband and wife, &c.

**RELAXATION**, in medicine, &c. the act of loosening or slackening, or the looseness and slackness of the fibres, nerves, muscles, &c.

**RELAY**, a supply of horses placed on the road, and appointed to be ready for a traveller to change, in order to make the greater expedition.

**RELEVANCY**, in Scots law. See **LAW**, Tit. xxxiii. 48.

**RELICS**, in the Romish church, the remains of the bodies of saints or martyrs, and the instruments by which they were put to death, devoutly preserved, in honour to their memory; kissed, revered, and carried in procession.

**RELICT**, in law, the same with widow.

**RELIEVO**, or **RELIEF**, in sculpture, &c. is the projection or standing out of a figure; which arises prominent from the ground or plan on which it is formed; whether that figure be cut with the chisel, moulded, or cast.

There are three kinds or degrees of relievo, *viz.* alto, basso, and demi relievo. The alto-relievo, called also haut-relief, or high relievo, is when the figure is formed after nature, and projects as much as the life. Basso-relievo, bas-relief, or low relievo, is when the work is raised but a little from the ground, as in medals, and the frontispieces of buildings; and particularly in the histories, festoons, foliage, and other ornaments of friezes. Demi-relievo is when one half of the figure rises from the plan.

When

When, in a basso-relievo, there are parts that stand clear out, detached from the rest, the work is called a demi-basso.

RELIEVO, or RELIEF, in painting, is the degree of boldness with which the figures seem, at a due distance, to stand out from the ground of the painting.

## RELIGION, OR THEOLOGY.

I. TO know God, and to render him a reasonable service, are the two principal objects of religion. We know but little of the nature of bodies; we discover some of their properties, as motion, figure, colours, &c. but of their essence we are ignorant: we know still much less of the soul; but of the essence or nature of God, we know nothing: it is the prerogative of the Supreme Being alone to comprehend his own essence: all the efforts that we can make to attain that knowledge, are arrogant and ineffectual; it is foreign to the nature of a limited spirit: but our destiny is that of a man, and our desires are those of a God. In a word, man appears to be formed to adore, but not to comprehend, the Supreme Being.

II. We may say, however, with Virgil, *Jovis omnia plena*; God manifests his existence, not only to the internal sensations of our minds, but in every object that surrounds us in the whole frame of nature; and if we cannot comprehend the Supreme Being by our senses, we may discover his attributes by our reason, almost as clearly as we distinguish the properties of matter, and many other objects; and this knowledge is sufficient for us. The end of every other science is some temporal happiness; theology alone proposes an eternal felicity; its object therefore differs from all other sciences, as the age of threescore and ten differs from eternity. We cannot wonder therefore, that all the inhabitants of the earth, from the time of the creation, have made it their principal study, and have exerted all their abilities in the cultivation of it: we ought much rather to be astonished that it does not yet more strongly engage the attention of mankind; and that while they labour so assiduously to acquire those sciences, whose utility extends to so short a space of time, they should so frequently neglect that object which can secure their felicity in a future, certain, and eternal existence.

III. From the first knowledge that we have of the world, that is to say, for about five thousand years past, men have blindly searched after the idea of the true God; and by the weakness of their discernment, they have fallen into a thousand errors. Paganism at first covered the whole earth, except that family alone which became the stock of the Jewish people: this paganism among different nations had different mixtures of idolatry. Moses first made known to the Hebrews the true God, and prescribed them his worship: his religion, however, was not adopted by any other people, not even by their neighbours. Jesus Christ appeared upon the earth, abolished a part of the Judaic law, reformed the religion of Moses, taught his divine doctrines, and offered himself as a sacrifice for the salvation of mankind. His gospel made a happy progress over all Europe, that is, over the then known part of the earth. Some time after, Mahomet arose in the east and preached a religion that he had compounded of the Jewish and Christian, and of his own ideas. Lastly, came Luther and Calvin, who reformed the errors which, according to them, had been introduced into Chri-

stianity under the reigns of the popes; and gave the idea of what is called the Protestant Religion. Confucius had taught the Chinese, and Zoroaster the Indians, religions drawn partly from philosophy, and partly from paganism; but the extent of these was very confined. All these religions, and their different sects, have had their theology, their priests, their ceremonies, their triumphs, and even their martyrs.

IV. We shall not speak here of religions that are extinct, or that yet exist, but at a distance far from us: we shall treat only of the Christian theology, which teaches us to know God, by revelation and by the light of reason, so far as it is possible for the weakness of the human mind to comprehend that inscrutable Being. The knowledge of the true God is indeed of little utility to man, unless he can suppose that there is some connection or relation between that Supreme Being and himself. Now it is from these connections or relations that are derived the necessity of the knowledge of the true God, and of the true manner in which he is to be worshipped: and this it is that forms the Christian theology; of which we shall now give the analysis.

V. To ascend by a chain of reasoning from things visible to things invisible, from palpable to impalpable, from terrestrial to celestial, from the creature even up to the Creator, is the business of theology: it is not surprising, therefore, that the union of many doctrines is necessary completely to form such a science. To understand, and properly to interpret the scriptures or revelation, demands not less sagacity than assiduity. The gift of persuasion is also essential to the ministers of the gospel. And lastly, the civil government has committed to their care certain functions of society, which relate, or seem to relate, either to the doctrines or morality of the gospel. They assemble, for example, in bodies to form consistories; they judge in matrimonial cases; they carry consolation and hope to the souls of the sick; they prepare for death those criminals which justice sacrifices to public safety; they take upon themselves the charge of *Ephori*, with the inspection of some pious foundations; they distribute alms; they administer the sacraments, &c.

VI. To discharge fully so many duties, the theologian has need, 1. Of several preparatory studies; 2. Of some theoretic sciences; and, 3. Of many doctrines which have for their object his ministerial office. The first are,

1. The languages; and among these,
  - (a) His native language, in which he is to preach and exercise his ministry, and with which he ought to be perfectly acquainted.
  - (b) The Latin language, which is the language of the learned world in general.
  - (c) The Greek language, in order to understand the New Testament.
  - (d) The Hebrew language, of which the Talmudian and Rabbinical idioms are a part.
  - (e) The Arabic language.
  - (f) The Syriac language.

(g) The

(g) The French language. And

(h) The English language. The two latter of which now appear necessary to every man of letters, and particularly to a theologian, on account of the excellent works which are wrote in those languages.

2. The principal parts of Philosophy; as,

(a) Logic.

(b) Metaphysics.

(c) Moral philosophy.

3. Rhetoric and eloquence, or the art of speaking correctly, of writing with elegance, and of persuasion.

To which may be added,

4. The elements of Chronology, and Universal History.

5. The study of the Jewish antiquities.

He who would devote himself to the important employment of a theologian, and has the noble ambition to excel in it, should early impress on his mind these truths: that the years which are passed at an university are few; that they run rapidly away; that they are entirely engrossed by the theoretic sciences; and that he who does not carry with him to the university a fund of knowledge in the preparatory parts of learning, commonly brings very little away, when his age or his parents oblige him to quit it.

VII. The theoretic sciences of a theologian are,

1. The Dogmatic, or the theory of theology; which some Latin authors name also *thetica*, or *systematica*.

2. The Exegesis, or the science of attaining the true sense of the holy scriptures.

3. The Hermeneutic, or the art of interpreting and explaining the scriptures to others. This differs in general but little from the exegesis, and in some respects is quite the same.

4. Polemic theology, or controversy.

5. Natural theology.

6. Moral theology.

7. Sacred criticism.

8. The history of the Church, under the Old and New Testaments.

VIII. The practical sciences of a theologian are,

1. Pastoral theology, which is divided into,

(a) Homiletic.

(b) Catechetical.

(c) Casuistic.

2. Consistorial theology, which comprehends

(d) The Canon law.

3. The prudential exercise of the different functions of the ministry.

We do not here particularly name the *patristic theology*, (*theologia patrum* seu *patristica*;) because all Christian communions are not agreed in their opinions concerning the degree of authenticity and infallibility that is to be attributed to these ancient fathers of the church. The Protestants believe, that these primitive theologians were liable to error in their sentiments as well as those of our days: and, in all probability, that they were less skillful, less learned, less clear, and less accustomed to close reasoning, than the latter, as philosophy was then more imperfect. But as we find in the writings of these fathers, many elucidations of the doctrine of the primitive apostles, and many irrefragable testimonies of the authenticity of divers remarkable events, which serve to establish the truth of Christianity; and as we there see, moreover, the origin of errors, of arbitrary ceremonies, and of many doc-

trines that have been introduced into the Christian church; the reading and the study of these fathers cannot but be of great utility to the theologian. To a virtuous citizen, who unites such various sciences, and employs them in pointing out to his fellow citizens the path that leads to temporal and eternal felicity in a word, to a wise theologian, what veneration is not due?

#### Of the DOGMATIC.

I. UNDER the general term of dogmatic, we comprehend that part which the different writers on theology have called sometimes theoretic, sometimes systematic, and sometimes thetic theology, &c. The term dogmatic appears to us the most general, and the most just, to express the subject that we intend, as it comprehends an entire system of all the dogmas or tenets that each religion professes; whether it teach these dogmas by the way of thesis, as articles of faith; by public lecture; by catechising; or any other manner whatever.

II. Every positive religion must, naturally, have a system of certain points of doctrine to propose to its followers; otherwise, each one would form a particular system according to his own fancy. there would be as many different religions as there are individuals on the earth, and each society would consist of a confused mass of fantastic opinions; as the different modes of thinking, and the different degrees of discernment, are varied and compounded by mankind to infinity; but truth, on the contrary, is uniform and invariable.

III. The Christian religion is as compound in its dogmas, as it is simple in its moral principle. It includes, 1. The dogmas founded on the lights of reason: 2. Those drawn from the Old Testament, and the law of Moses: 3. Those taken from the New Testament, and the doctrine of Jesus Christ: 4. Those that the fathers of the church have drawn from the Holy Scriptures: 5. Those that the church, under the New Testament, has prescribed to Christians, by œcumenical and other councils assembled in different ages: 6. The dogmas that the popes, in quality of heads of the church, have established by their bulls: and to these must be added, on the part of the protestants, 7. The dogmas that the reformers, especially Luther and Calvin, have taught: 8. The decisions of synods; and lastly, the tenets that are maintained by the different sects, as Socinians, Anabaptists, Quakers, &c. Each of these particular religions or sects pretend to support their dogmas both by reason and revelation: we do not here offer a work of controversy, and are very far from attempting to determine on which side truth and reason are to be found.

IV. Our zeal, however, for the Christian religion in general, which we regard as perfectly divine, and as the only religion adapted to promote the happiness of mankind in this world, and to secure it in the next, and the desire we have that it may endure to the end of time, compel us to make in this place one important reflection; which is, That simplicity is ever an essential attribute of perfection, as complexity is of imperfection. Now, it cannot be denied, without doing violence to truth, that among the different dogmas of which we have been speaking there are several that seem to be founded on speculations very abstruse, on subtilties very intricate, and on interpretations very ambiguous. God certainly never intended that all mankind should be the dogmatics; he has not given them his divine word to be the cause of discord among men, nor that they should pass their whole lives

lives in a painful search after *objects of belief*, and *articles of faith*; and that they should forego, in that pursuit, the necessary offices of life, and their duties as citizens. The dogmas, then, essentially necessary to the welfare of mankind, ought to consist of a small number, and to bear the marks of simplicity and perspicuity; without which they must be imperfect, and consequently the work of man. Our intention, in making this remark, is, to extend our voice, if it be possible, even to posterity, whom we would conjure not to injure our religion, so holy and so admirable, by a multiplicity of dogmas. It is necessary, however, that the divine, who makes it his study and his profession, should be thoroughly acquainted with the theory of this science, in order that he may be able to instruct the sincere Christian, and to explain the nature of each particular dogma, as well as the solidity of its proofs; and to this it is that the study of the dogmatic leads; of which we shall now continue the analysis.

V. The dogmatic is then nothing but a *succinct exposition of all the dogmas of the Christian religion, in a natural and philosophical order*. By the word philosophical, we do not here precisely mean the method of mathematicians, in the manner the late M. Wolff has applied it to philosophy; every subject is not capable of a demonstration so exact and rigid; but a regular order is required in the arrangement of the general system, and a connection is to be preserved in the several matters that form it: the definitions should be just; the divisions exact; the arguments solid; the proofs clear; the citations conclusive; the examples striking; and, in a word, every thing should be adduced that appertains to so important a discipline.

It is very essential, moreover, in the dogmatic, at the beginning of each thesis, to explain the several terms that are peculiar to it, and that use has established in treating of theology; to draw from each definition certain axioms, and from thence to form propositions, and to illustrate them by solid reasoning. Lastly, we should not neglect, in such a system, to make use of the expressions used in the symbolic books that have been received by the whole Christian church, and which cannot be rejected or altered, without causing a confusion in our ideas, and in the general system of the Christian religion. But before we make the least advance in the study of Christian theology, it is indispensably necessary to examine the proofs by which the truth, the authenticity, and the divinity of the sacred and canonical books are established; for this is the foundation of all the dogmas and the axis on which its whole doctrine turns.

VI. The systematic part of the Christian religion, among the great number of its dogmas or theses, has *three principal*, from which all the rest are derived, and which form the basis of its whole doctrine:

1. The existence of one God in three persons.
2. The necessity of a Mediator or Redeemer.
3. The real appearance of the Mediator or Messiah on the earth.

Whoever writes, professes, or teaches the dogmatic, should be, above all things, careful well to establish these important truths; to evince them by the strongest and most evident proofs, drawn partly from the lights of reason, and partly from revelation: and he will then see, with what facility all other theses flow from, and how easy it will be to prove them by, these.

VII. The infinite variety that is found among mankind in their manner of thinking, and in their method of treating subjects; the frequent changes that have happened in the exterior form of philosophy, and in the method of treating it; the oppositions that have been raised at all times against divers doctrines of the Christian religion; all these have produced, among theologians, different systems of the dogmatic. Sometimes they have combined positive theology with morality, and have formed a system that they call *theologia theoretico-practica*, or *theologia thetico-moralis*, &c.: sometimes they have refuted the arguments that others oppose to certain theses; and from thence has arose a system that they call *theologia thetico, or dogmatica, or positivo-polemica*: sometimes they have joined to natural theology that of revelation; and have formed a dogmatic, called *philosophico-theologica*: and so of the rest. But, besides that these distinctions and denominations are in themselves pedantic, it is at all times more eligible, in every science, to avoid confounding with each other the several branches of which it consists. The different dogmas, morality, philosophy, and controversy, are separate articles; and when each of these parts of theology are separately treated, they are disposed with more order in the mind, and a greater light is diffused over their several subjects.

VIII. It appears, moreover, from the simple enumeration that we have made, in the third section, of the different principles on which the dogmas of the Christian religion are founded, that, to be thoroughly acquainted with its whole theory, the theologian should also apply himself to the study of the symbolic books of its communion, and especially should be well versed in the *Creed of the Apostles*; that of *Nice* and *St Athanasius*; the book called *Formula concordia*; the *Theses of the council of Trent*; the *Catechisms of Luther*; the *Confession of Augsbουργ*; the *Articles of Smalcalden*; the *Catechism of Heidelberg*, &c. That he should be well acquainted with that part of Theology that is called *patristica*: that is to say, that he should be well read in the fathers of the church; that he should not be ignorant even of *scholastic theology*; that he should at least know the frivolous subtilities and the complicated method of the ancient scholastic divines, which was derived from the philosophy of Aristotle and the schools; that he should make a serious study of the *sacred history of all ages, the councils and synods*; that he should, above all, never lose sight of *natural theology*; and, lastly, that it is indispensably necessary that he should procure a good bibliography or treatise of ecclesiastical writers\*, which he may consult occasionally, and learn from thence to know the best guides. The more a theologian applies himself to all these subjects, the more ability he will acquire in this science, and the more perfect he will be in the theory of that religion which it is his duty to teach to others.

IX. Revealed religion being founded (at least in great part) on natural religion, and philosophy being the source from whence the principles and the knowledge of the latter are derived, it is evident that philosophy is intimately connected with theology: nevertheless, the aid of the former is to be employed with precaution, and is not to be regarded as the foundation of the theological dogmas, but only as a mean by which they may be explained and enforced. The Holy Scriptures constitute, perpetually, the true basis of revealed theology: philosophy effectually concurs, however,

\* Those of Du Pin and William Cave are most celebrated.

to prove the existence and the attributes of the Supreme Being; the necessity of the creation of the universe by Almighty God, in opposition to every other possible manner of its being produced: it furnishes, moreover, plausible conjectures concerning the intention of the Almighty in creating this world; it proves the necessity of a perpetual power to preserve it; it supposes, that, as God could not produce any thing that was not perfect in its kind, he could not have created man as he now is; it vindicates the conduct of the Supreme Being, in appointing chastisements for transgressions, by shewing that moral evil was not introduced into the world by absolute necessity, but by the abuse of liberty, the most noble prerogative of the human soul; it determines the necessity of a Mediator; it furnishes arguments for the belief of the immortality of the soul, and of a future state that has a relation to the moral actions of this life; and lastly, it inspires a love of God as a Being of sovereign perfection, a gratitude towards him as our creator and preserver, and a submission to his will as our supreme ruler and director, motives of all others the most powerfully conducive to a virtuous conduct.

X It is this use which theology makes of philosophy, that has given occasion to divide the theses of the dogmatic into pure and mixed; that is, into theses that are founded entirely upon revelation; and, such as arise from an union of reason with revelation. Of the first sort are, 1. The article of the Holy Scripture itself; which treats of its divine origin, its authority, and its efficacy. 2. The dogma of the Trinity. 3. That of the origin of evil, or of original sin. 4. The whole article of Jesus Christ. 5. The dogma of the efficacy and operations of the Holy Ghost. 6. That of the sacraments. 7. That of repentance. 8. That of the belief in Jesus Christ. 9. That of good and bad angels. 10. That of the end of the world, and the last judgment. 11. That of the church, &c. The mixed dogmas or theses are, 1. The doctrine of a Supreme Being, in general; his being, his attributes, and his works. 2. That of the creation. 3. That of providence, or the conservation of the world. 4. Of sin, as a transgression of the laws of God. 5. Of rewards and punishments after death, &c. He that attentively studies, thoroughly comprehends, and well digests all these theses, will have reason to rest content with his knowledge of the dogmatic.

#### *Of the EXEGESIS and the HERMENEUTIC.*

I. THE term *Exegesis* is derived from the Greek verb ΕΞΕΓΩΝΤΑΙ, which signifies to relate or explain; and that of *Hermeneutic* from ΕΡΜΕΝΕΥΕΙΝ, which means to search into, and, in a figurative sense, thoroughly to examine, and interpret. The learned, but especially the theologians, make use of these words, sometimes as synonyma, to express the same thing, and sometimes (as there are scarce any terms that are perfectly synonymous) to denote a small difference between two parts of learning of the same nature. By the word *Exegesis* they mean, *that science which teaches clearly to investigate the true sense of the original text of the holy scriptures*; and by the *Hermeneutic*, *the art of interpreting and explaining the holy scriptures to others* \*. This distinction is so subtle, that it becomes almost frivolous. They are, in fact, the same science; the one is only an explication of the other, and for that reason

we think we are authorized to treat of them together in this place.

II. In order to the true understanding of the sacred text of all the books contained in the Holy Bible, whether of the Old or New Testament, it is absolutely necessary that the theologian be thoroughly acquainted, not only with the languages in which these books were originally wrote, but likewise with the history and antiquities of those remote times in which their authors lived. With regard to researches into the history of the Jewish nation, their antiquities, their morals, and their customs, it will be found advantageous to pursue it as far as the nature of the subject will admit, without, however, engaging in critical subtleties, that lead to a labyrinth to which there is no end, and have spread more clouds over theology than even the scholastic controversies have formerly done.

III He who would successfully interpret any work whatever, should first consider the spirit in which it is wrote: he should attentively reflect on the general design of that work, and the particular motives that induced the author to undertake it; his genius, his passions, his taste; the time, the place, and the people for whom it was written. These considerations are, above all, necessary, when we would undertake the explication of the Holy Scriptures. Independent of those reflections which the theologian will of himself naturally make on the subject, the excellent commentaries which we have on the Bible, in which the greatest men of every age have exercised their genius, may serve him as a guide in this course. The critical histories will likewise afford great aid, and throw admirable lights on this matter. Clear ideas, an acute discernment, and a solid judgment, will complete the work.

IV. With regard to the languages necessary for understanding the sacred text, the Hebrew language hold the first place. The student should have early recourse to the *manner of accenting*, and the *Massoret* of the Jews: to these he may add, with advantage, the reading of the Jewish interpreters or *Rabbins*. There are the grammars and dictionaries, Rabbinic and Talmudic, of Buxtorff, Cellarius, and others, which greatly facilitate his study. The Talmud it is true is stuffed with a thousand fables and ridiculous stories; it contains, notwithstanding, some things useful and curious, which the learned theologian should not entirely pass over. For the well understanding of the explications and applications of the best Rabbins, he should likewise have recourse to their *Cabbala*, which they divide into *read* and *liberal*.

V. The *Massoret* is a kind of critic on the Hebrew text, that the ancient Jewish doctors invented, in order to prevent any alteration. They there count the verses, the words, and the letters of the text, and have marked all their diversities. The text of the sacred books was formerly wrote in close continuation, without any distinction of chapters, verses, or even words, after the manner of the ancients, as we still see in many manuscripts. As the sacred books have undergone an infinity of changes, which form various readings; and as the true original has been either lost or altered; the Jews have had recourse to this rule, which they have judged infallible, and which they call the *Massora*, to fix the reading of the Hebrew text.

VI. The ancient Rabbins, or Doctors of the Jewish law, have

\* The *Exegesis* is a kind of rational grammar. The *Hermeneutic* is the art of interpreting entire passages.

have wrote many superstitious traditions, which they observe as scrupulously as the law of Moses; and have also made many commentaries on the sacred text, among which there are some that are good and useful. The language they use is different from the common Hebrew, as is also the Rabbinic character.

VII. The *Talmud* is a book in which the Jews have comprised every thing that concerns the explication of their law, and the duties that are enjoined them by scripture, by tradition, or by authority of their doctors; by their particular customs, their civil government, their doctrine, their ceremonies, their moral theology, the decisions of cases of conscience, &c. The *Talmud* is composed, in general, of two parts; which are called, the *Mishna*, and the *Gémara*. The Jews would not at first commit these things to writing; but after the destruction of Jerusalem, finding themselves dispersed in the world, they became obliged to do it. They had two celebrated schools, one at Babylon, and the other at Jerusalem; at these schools were made two different collections of traditions, each of which is called the *Talmud*. The commentary, called *Gémara*, contains the decisions of the Jewish doctors, and their explications of the text; it is filled with absurdities, reveries, and ignorance, and written in a vulgar style. On the contrary, the text, that is called *Mishna*, consists of solid reasoning, written in a pure style. The Rabbins Moses, son of Maïmon, has made an abridgement of it, which is of more value than even the *Talmud* itself.

VIII. The *Cabbala* or *Kabala* (a Hebrew word, which properly signifies tradition) contains the different interpretations of the laws of God by different Rabbins; their decisions on the obligations that they impose, and the manner of performing them. There are some of them that are occult and mysterious, and consist in singular and mystic significations which are given to a word, or even to each of the letters that compose it; and from these various combinations, they draw explications of the scripture very different from that which it seems naturally to import. This *Cabbala* is divided into three kinds: the first they call *Gématria*, and consists in taking the letters for the numbers of arithmetic, and explaining each word by the arithmetick value of the numbers that compose it: the second is called *Notaricon*, and consists in taking each letter for a word, or in composing a word of the first letters of several words: the third is called *Trémura*, and consists in changing a word, and the letters of which it is composed.

IX. The *Chaldee* seems to be indispensable, after the study of the Hebrew and Rabbinic; this is properly no more than a particular dialect of the Hebrew language. The Jews give to their commentaries, and to the Chaldaic paraphrase on the Scripture, the title of *Targum*. As, during their long captivity in Babylon, they had forgot the Hebrew, and only retained the Chaldaic language, it became necessary to explain the prophets in that language; and to this necessity is owing the first commencement of the Chaldaic paraphrase. The Rabbins have since collected together these divers interpreters of their doctors, which form the paraphrase that is called *Targum*.

X. The other oriental languages, as the Arabic, the Syriac, the Samaritan, and the Coptic, are also of great use to the learned theologian.

XI. All the books of the New Testament being wrote in Greek, the study of that language becomes necessary to the

theologian. But it must not be imagined, that this Greek is that of Athens or Lacedæmon; and that they who understand the New Testament, will fully comprehend Homer, Anacreon, or Thucydides. It is very necessary to observe, here, that during the Babylonish captivity, the Jews, as we have just said, having forgot the Hebrew, and having adopted, in process of time, several idioms, the Greek language was at last successfully diffused over almost all the east; and, at the time of the coming of Jesus Christ upon the earth, that language was in use in Palestine, not only among men of letters, but in the polite world: every thing was wrote, every thing was treated of, in Greek. The Jews no longer understood the Holy Scriptures in the Hebrew language, but made use of the version that the Septuagint had made of the Old Testament in the Greek language. The evangelists and the apostles, therefore, wrote their historic relations, as well as their epistles or letters in the same language: but their style is not pure, being strewed with hebraisms and barbarisms, and with theological terms and phrases. The four evangelists differ, moreover, among themselves, with regard to their style; and so do the apostles: St Matthew is not so elegant as St John; nor St Jude so elegant as St Paul, who was a man of letters, and an able writer. The diction of St Luke is the most elegant, and most correct, especially in his book of the acts of the apostles.

XII. The translations that have been made of the sacred books in the west, will also very frequently assist in clearing up many passages.

XIII. The Jewish antiquities are naturally connected with the study of the sacred history of the Old Testament. *Josephus* is the best author who has wrote on this subject. *John Marsham*, *Vossius*, *Ivius*, *Gyraldus*, &c. are the moderns to whom we are indebted for learned researches in these matters. *Hermannus Wilsus*, in his treatise *de Ægyptiacis*, has thrown admirable lights on the Egyptian antiquities. The antiquities of the Chaldeans, Babylonians, Persians and Medes, has been excellently well explained by *Barnabæus Brisson*, in his book *de regno & rege Persarum*; and by *Thomas Hyde*, in his treatise *de religione et sacris Persarum*. The writings of *Meursius*, and the *Compendium Antiquitatum Græcarum* of *John Potter*, are very useful to give theologians an idea of what they will find necessary to know of the Grecian antiquities; and lastly, the abridgement of *Cantel* will make them sufficiently acquainted with the Latin antiquities.

XIV. *Spencer* has given an excellent work on the ceremonies of the Jewish religion, *de Legibus Hebræorum ritualibus*, &c. We have likewise works that fully treat of their temples, their sacrifices, their priests and Levites, their passover and purim, of their tithes, their vestments and sacred habits, and of their manners and customs; but it would be too prolix to mention all these in this place.

XV. The modern commentaries on the Holy Scriptures may also serve to instruct the young theologian; but he should use them with caution and moderation. All that glitters is not gold, as well in this instance as in others; and a man of learning should not often make use of other people's eyes.

XVI. The Bibles called *Polyglots* are also of great assistance in interpreting the sacred text. They are printed in several languages. The first is that of cardinal *Ximenes*, printed in the year 1515, and called the *Bible of Complute*; it contains the Hebrew text, the Chaldaic paraphrase,

phrase, the Greek version of the Septuagint, and the ancient Latin edition. The second is that which is called the *Royal Bible*, printed at Antwerp in 1572. The third, that of *le Jay*, printed at Paris in 1645. The fourth is the *English polyglot*, printed at London in 1657, of which Walton is the editor. There are still several more that have been printed since, but they are neither so complete nor so celebrated as the former.

XVII. The Bibles that are called *Biblia Glossata*, are also here of very great use. The sacred text is there every where accompanied with explanations and observations. There are of these in each of the three principal communions of the Christian Religion, and in most of the modern languages of Europe. Lastly, as the interpretation of the sacred text depends in a great measure on the lights and the proofs drawn by comparing together different passages of scripture, there are several Bibles where the editors have placed, on the side of each verse of the text, what they call the *Concordance*, that is, a citation of other parallel passages, which are found dispersed in the Old and New Testament. These Concordances are of daily and indispensable use to the divine, in composing his sermons, and in many parts of his ministry. See BIBLE.

XVIII. These parallelisms are yet different from that which theologians call the *real parallelism*; by which they mean, the relation that the typical or parabolic sense of a passage has with what the expressions literally imply, or seem to imply; the mystic sense with the real sense; the figures and the images that the sacred authors have employed, with the things or the objects that they intended to describe. The greatest theologians have taken infinite pains in determining these points, explaining them, and producing their proofs: in many places they have succeeded; and we cannot but admire their sagacity, their zeal, and their success: it must be acknowledged, however, that they have not yet cleared up all the obscurities; that there are many dark passages still remaining in the prophets, in the Song of Songs, in the book of Job, and above all in the Apocalypse; on which have been hitherto thrown mere glimmerings, which are very far from affording a sufficient light. The explications that have been attempted of these passages are frequently so unjust, so unnatural, and improbable, and at the same time so futile, that they rebel against common sense, and only give us occasion to deplore the imbecility of the human understanding.

XIX. The last labour of him who would become acquainted with the Hermeneutic, is in what is called *Leitio Acroamatica*; by means of which, each book of the Holy Scripture is examined from one end to the other, with relation to geography ancient and modern; genealogy, chronology, history, and antiquities; from whence a rational system is formed, according to the rules of sound logic. This work is attended with so many difficulties and distractions, that it is almost impossible to accomplish it, without the assistance of a guide, an able professor, and a complete academical course.

XX. Furnished with these ideas, the theologian may venture to investigate the true sense of those passages of Holy Scripture that may appear to him obscure, contradictory, or difficult, and to interpret them to others: but he will be more wise, and less vain, than to attempt to impose his decisions on mankind, at all times, as authentic and infallible. The human discernment is ever confined and imper-

fect; and God has not granted to any man, to any theologian, or assembly of divines, an exclusive power of interpreting his divine word: he has moreover denounced his anathema against all those who shall add, or take away, a single word thereof. But to explore the true sense of any passage, and to explain it to others, cannot certainly be deemed either adding or retrenching.

#### Of SACRED CRITICISM.

I. As the authors and professors, who treat of the different parts of theology, make frequent mention of the sacred criticism, we must not omit to shew in what manner it is connected with the Exegesis and the Hermeneutic, and in what respect it forms a separate doctrine or science. Criticism, in general, is in fact no more than a superior part of grammar; a kind of rational grammar founded on reflection, and the rules of language; but which employs the aid of divers other sciences, as history, chronology, antiquities, &c. in order to search out and determine the true sense of an obscure or ambiguous passage. The sacred criticism is only distinguished by its object; it adopts the same rules, but it adds others which take their rise and principles from the peculiar language of the New Testament; and has regard to the Bible in general, an account of the nature, essence, and qualities of its divine Author. So far it has an intimate connection with the Exegesis.

II. But, if we would consider it as a separate study, we may say, that it is a science which is employed in examining the exterior circumstances of the Holy Scripture. For example: in what time each book was wrote; who was its author; the precision and fidelity of the text; the distinction between the canonical books and the apocryphal; and many other matters of like nature. In order still the better to shew in what manner, and with how much precaution, the sacred criticism proceeds in its operations, we shall here recite some of those subjects that belong to its province.

III. It is commonly received, that it was Esdras who, after the return from the captivity of Babylon, collected and fixed the canon of the sacred books of the Old Testament. This at least is the opinion of the Jews, who all attribute to him that glorious work; and the assertion appears so much the more probable, as it was the same Esdras who reestablished their state, who brought the whole Jewish people into one body as a nation, and formed the Judaic republic, which was so intimately connected with their religion. The collecting of the canon of the books of the New Testament is attributed, with great appearance of probability, to St John; although historic and formal testimonies of it cannot be produced, unless it be what Eusebius relates of the four Evangelists. In process of time, each council has decided what books should thereafter be held by the Christian church as canonical; and we commonly find, at the end of the decrees of each council, a repertory or list of those books.

IV. The Old Testament was wrote in Hebrew, except a small number of passages where the dialect is Chaldean. The form of the letters or characters, as we now have them, are also properly Chaldean; whereas, before the Babylonish captivity, the Samaritan character was probably used. Buxtorff and Capell have had warm disputes upon the subject of the vowel-points: the former would retain these points, and the latter rejects them; each of them has had his adherents. As it is impossible to decide in this dispute but by historic proofs;

proofs; and as these are not to be had, either for one side or the other; it is best to leave the affair undecided: not totally rejecting the points, however; as they are of infinite use in the study of the Hebrew language. They who love to introduce novelties in religion, (say the partisans of Buxtorff,) would doubtless be charmed to see the points totally abolished, because they then could make whatever they pleased of the sacred text. The adherents of Capell maintain, on the contrary, that by the ignorance or inadvertence of copyists, these points may have been transposed formerly, or may be easily confounded and wrong placed hereafter; which may occasion the most dangerous errors; may give rise to contrary meanings, and whimsical explanations of the Scripture; whereas, by not admitting the points, an able theologian will preserve, at least, the liberty of explaining a passage according to analogy, and the rules of good sense.

V. The accents have given rise to full as many disputes. But this question is not decidable but by the same method as the preceding: for we clearly see, by all the ancient manuscripts, that even the Greeks and Romans have wrote without accents, but that both one and the other make use of vowels. In poetical works especially, it is almost impossible to omit them; and that language being now dead, without accents we can find no cadence, no measure. Father Montfaucon asserts, with great appearance of probability, that accentuation was not introduced till the seventh century.

VI. The language of the New Testament is the Greek; for all that is said of the gospel of St Matthew being wrote in Hebrew, and of that of St Mark being originally composed in Latin, is but weakly supported. The style, as we have already remarked, is not pure, whatever some zealots may improperly, and without reason, assert to the contrary. The language of the New Testament abounds with hebraisms.

VII. The precision, the truth, and correction of the text, is the result of repeated and judicious comparisons of the variations; of which there are, according to Dr Mill, more than twenty thousand. These variations have proceeded, partly from the negligence of the copyists, and partly from the ignorance of the revisors and correctors of the ancient manuscripts, who have frequently added and inclosed the comments, which were wrote in the margin, with the text. The heretics of the first ages, and the impostors, have also made divers alterations in the text itself, in order to support their errors; and these alterations have slid into other copies. It is the common rule to follow the most ancient manuscripts; as it is supposed, with reason, that they are the most correct: and to these are also added the most ancient versions.

VIII. The first of these versions is that of the *Septuagint*, which has been at all times highly esteemed, as well by the Jews as the Christians. The Hebrew language being lost by the Jews during the captivity in Babylon, and the Greek dialect becoming the common language of the east, that version was made in Egypt by public authority, and for the use of the common people. The second is that called the *Vulgate*, which was formed from the translation of St Jerome, and from another that was called *Versio antiqua*: After these two translations come the Greek versions, among which are reckoned. 1. That of *Aquila*, who has translated the original Hebrew verbatim, by putting over each word of the Hebrew text, its corresponding Greek term. 2.

That of *Symmachus*, who applied himself to write the Greek with purity and elegance. 3. That of *Theodotion*, who has very closely followed the text, notwithstanding the fine language he employs. *Origen* published these versions in six languages in his edition of the Old Testament, which he calls *Hexapla*. To all these versions may be added, 4. Those of *Jericho* and *Nicopolis*, which are much celebrated. We have not now any one of these versions entire. The fragments that remain of them have been collected and published by *Drusius* and *F. Montfaucon*. Lastly, The *Syriac versions*, of which one was made on the Hebrew text, and the other on the Greek.

IX. The sacred criticism is likewise employed in acquiring a knowledge of the principal and most celebrated manuscripts, as well of the sacred text itself, as of the translations; in learning to discern the hand-writing, and the essential characteristics which distinguish the real original from the counterfeits: and lastly, it is employed in knowing the best modern editions of the Holy Bible; as for example, the Polyglots, among which those of London, and of the years 1653 and 1655, are the best. The introduction by Walton, which is at the beginning of these editions, is a model and a masterpiece of sacred criticism.

#### OF MORAL THEOLOGY.

I. IF it were allowable to compare the Saviour of the world to a weak mortal, we would say, that the conduct of Jesus Christ resembled that of Socrates, who has left us no part of his doctrine in writing, but whose whole instructions (as well as the particulars of his life) have been collected, digested, and published, by his disciples. The Evangelists are the only historians of the Messiah: it is to their labours that we owe the knowledge of his actions upon earth, and his divine doctrine. The four Evangelists, and the Acts of the Apostles wrote by St. Luke, contain therefore *alone* the history of the life of Jesus Christ, and the doctrine that he taught. His apostles, and disciples began by paraphrasing his doctrine, as well by their evangelic sermons, as in the epistles they addressed to the faithful of several Christian Churches: they have given explanations, and have added pastoral instructions, which are in effect admirable; but which, nevertheless, form not the original text of the discourses of our Saviour. The bishops of the apostolic century, the fathers of the church in all succeeding centuries, the other bishops and ecclesiastics, the councils, the synods, the doctors of theology, the popes, the consistories, the reformers likewise, and an infinity of theologians, have drawn from the Gospel, and sometimes also from the letters of the apostles, and from other commentaries on the Gospel, various tenets; which, united, form at this day the general system of the Christian Religion. The theologians who devote themselves to the service of the altar, study this system in the dogmatic: the laity learn it by means of catechisms; and after they have made confession of their faith, solemnly adopt it, when they are received into the bosom of the church.

II. It is not the same with regard to the morality of Jesus Christ, which every one may read in the Gospel; and to know which, it is not necessary to become learned, nor to study a complicated system. If the dogmatic were not armed with a thousand arguments to establish the Divinity of Jesus Christ, yet would the morality of his Gospel sufficiently prove it; seeing that it is perfectly holy, entirely simple,

simple, strictly just, and most completely adapted to promote the felicity of the human race in this world, and in that which is to come. The Saviour of the world has not enjoined any part of mankind to engage in disputes, or abstract refinements: the sole command that he has given them is, *to believe in his Gospel*; and that is comprised in one word only, LOVE: the grand and only principle on which the whole of his sacred doctrine is founded.

III. To produce the greatest effects possible, by the least efforts, is the highest perfection in nature, and at the same time the true characteristic of Divinity. God has given to all the beings that compose the universe, one simple principle alone, by which the whole, and every part, is connected and perpetually supported; and that is LOVE. The attraction of the celestial bodies; as well as of those of which our globe is formed, is a species of *love*; a mutual tendency toward each other. The uniform generation, by which all beings are perpetuated, is founded in *love*. This is the true *minimum*, the true system of the *least action*, which includes something so divine. It appears to be the will of God to establish, by the mouth of the Messiah, the same simple principle in morality, that is, in the rule of human actions, by saying, *Love*: in a word, it was his will, that in the conduct of mankind, as in every other part of nature, there should be no other principle than that of Love.

IV. That in the different systems of ethics of the ancient Heathen Philosophers many maxims and precepts of admirable morality are to be found, cannot be denied; but, beside that these philosophers are almost continually contradicting each other in their maxims, no one of their systems is founded on the true principle. In searching after it, they have discovered some excellent truths; but it has been by chance, and they are at best imperfect. Jesus Christ has alone taught mankind perfect morals, by deducing them from this true principle. Every principle should be simple: the idea of a compound principle implies at once an imperfection. Every principle should be comprehensive, even universal in its effects. Every principle, whose effects are limited, is imperfect. God himself is uniform in his principle, and infinite in his effects. His doctrine, or his law, should be the same. Jesus Christ has made known to mankind this principle, simple and universal. He has therefore been, in this sense also, the true Saviour of the world. He has preached to mankind; and his only doctrine has been that of love.

V. By the word Love, with regard to *Bodies* in general, is meant a tendency, a mutual inclination that urges them to join and to coalesce; and with regard to men in particular, a lively, affecting pleasure, that possesses the mind on contemplating the perfections of any object. This pleasure is always accompanied with a desire, either to possess that object, or to render it propitious. By adopting therefore this principle, and this last definition of *Love*, it follows, that all the duties of man consist,

1. In the love of God in preference to all other objects.
  2. In the love of himself.
  3. In the love of his own species.
  4. In the love of every other creature to a certain degree.
- The doctrines of Jesus Christ are, in these respects, the most explicit.

VI. From this principle flows our *duty* towards God, towards ourselves, our neighbour, and to those beings that are subject to our power. The first rule is, to communicate to all those, whom it is our duty to love, all the good, and to

preserve them from all the evil in our power. The second, to do to no one what we would not have done to ourselves in similar circumstances. The third, which is the simple effect of love, is to endeavour to please the object that we ought to love. The fourth, to endeavour to render the pleasures that we communicate to others, as lively as possible, and those inevitable evils, which we are sometimes constrained to do to them, as supportable as we can; and so of the rest. The whole evangelic doctrine of our Saviour is replete, from beginning to end, with admirable precepts for these purposes; and these precepts, with their applications, general and particular, we learn from that science which we call Moral Theology.

VII. This doctrine we distinguish from moral philosophy, or the simple doctrine of Ethics; because Jesus Christ has made known, in his divine morality, a far greater degree of perfection than is discoverable by the mere light of human reason. For the renouncing of self-interest, and private pleasure; the forgiveness of offences; the love of his enemies; the triumph over destructive passions; and many other like virtues, the Christian is alone indebted to the doctrine of Jesus Christ.

VIII. In order to shew, moreover, in a few words, of how easy, just, and natural an application all these precepts are susceptible, we shall here give a few instances. "It is our duty to love God." Now nothing is more natural than to feel a lively and penetrating pleasure in the contemplation of the united perfections of the Supreme Being; nothing more natural than a desire to please him, and to render him propitious to us: and as it is not possible for us, weak creatures, to do him either good or evil, all our power to please him consists in offering him an upright heart; a rational devotion; to be possessed with gratitude toward him, and to exert all possible efforts to accomplish the end of our creation. "It is our duty to love all mankind;" and yet we inflict pains and chastisements on some of them; we even put them to death: but we chastise them only to render them better, to prevent them from becoming pernicious to society in general: we retrench the number of the living, as we cut off a corrupted branch of a tree, in whose preservation we are interested: it is because we love mankind, that we endeavour to prevent the destruction of the good by the malignity of the wicked: but it must ever be an indispensable necessity alone that can compel us to chastisement. "It is our duty, likewise, to feel a kind of love for other creatures, even for mere animals." Nevertheless we harrafs, we oppose, we destroy them. If we harrafs them wantonly, to support a criminal luxury, or to satisfy a brutal pleasure; if we pursue a savage chase, or encourage combats between animals themselves, or other like horrible diversions, we act contrary both to the Spirit and the letter of the Gospel. But if we destroy a part of these animals, to serve as an indispensable nourishment to man, observing at the same time to put them to the least misery possible, and taking all necessary care for the preservation of the species, we act in conformity to the laws of nature and of morality; we employ to our own preservation, and to that of the rest of mankind, what appears destined to that purpose by the Creator.

IX. Moral theology likewise differs from philosophy, inasmuch as it requires that our virtues be absolutely disinterested: it enjoins us to fly the evil, and to pursue the good, merely as our duty towards God: it admits indeed the precept of the love of ourselves, and the love of our neighbour;

but

but it regards this love only as a duty that results from our love towards God; and that from the principle, That God must love all his creatures as the work of his hands; and that we cannot therefore, from the very nature of love, please him, without entertaining sentiments of affection towards those to whom the Sovereign Lord of the Universe vouchsafes his benign regard. Now, as the Christian morality does not regard virtue, but as it is a duty towards God; and as it considers all our actions, that have any other motive, either as blameable, or at least imperfect, and as but little acceptable to the Supreme Being; it does not regard the advantages that result from them to society, but as useful consequences of the true Christian virtue; and from this principle it draws new arguments for the encouraging of mankind to the practice of it.

X. From what has been said, a second difference arises between Christianity and philosophy. The first adds to the second still new motives to the practice of virtue. That of redemption, and pardon, obtained by Jesus Christ, is not one of the least. Its argument is this: If God has so loved mankind, as to afford them the means by which the evil, caused by their own fault, may be abolished, it would be the greatest of all ingratitude and malice towards himself, if man should not endeavour to acknowledge this love, to merit it, and to embrace the means of pleasing God. A third motive, taken also from the merit of Jesus Christ, here offers itself as an auxiliary to the two former: According to the Christian doctrine, man has not by nature the power to practise all those virtues which are agreeable to God: but the same doctrine teaches, on the other hand, the conditions by which it is possible to please that most holy and perfect Being; and gives the Christian hope also, that he shall never labour in vain.

XI. Lastly, the Christian morality is of far greater efficacy in adversity, than philosophy: it carries with it a wonderful consolation in misfortune, and even in the hour of death; for the Christian may say, with the Apostle, *that godliness* (or the practice of evangelic morals) *is in all things profitable, having the promise of the present life, and that which is to come.*

#### OF POLEMIC THEOLOGY, OR CONTROVERSY.

I. We cannot sufficiently lament, that the church of the God of peace should be a *church militant*; and that a doctrine so simple and clear as that of the Gospel should be the cause of discord, even among Christians themselves. Nevertheless, as the truth is so difficult to discover in all things, and especially in matters of religion; as it is so frequently covered with the clouds of interest and ambition; as the same object appears so different to different men; and as error, in the face of the world, constantly assumes the mask of truth; it is but just that the true religion be furnished with arms to combat error, and to pluck off that deceitful mask by which so many poor mortals are seduced.

II. The theologian, who has made the proper preparatory studies, who is thoroughly instructed in natural religion, in the dogmatic and the hermeneutic, and who joins to these sound logic, is already well prepared for this spiritual combat: he is armed, but he is still to learn how to use these arms: he must also be made acquainted with the enemies he is to encounter, to know their force, and the arts they will use against him. It is plain enough, we suppose, that we here speak of spiritual arms; of those with which we are

furnished by reason and the Holy Scripture: evil be to him that employs any other: force is ever an infallible proof of the want of argument. The propagation of a religion by the sword, after the manner of Mahomet; persecutions, either secret or open; constraint, violence, every sort of religious war, is so atrocious, so contrary to the spirit of the Gospel, in a word, so detestable, that every true Christian must avert his sight from such infamous horrors.

III. Controversy is conducted, either from the pulpit or chair, by way of harrangue, by conversation, or by writing. The first quality that is necessary to a disputant is *reason*, and the next *moderation*; in what manner soever the contest is conducted, these two qualities should constantly be manifest, during the whole course of altercation.

IV. There are some errors that attack the *system* of religion, and there are others that attack even its *morality*. In order properly to oppose an error, we must begin by finding out its real meaning: we must therefore study the different systems of other religions, and the principal heresies, if we would successfully refute them. We don't mean by this, that the theologian should know all the errors that spring up in the brain of each individual; we speak only of those that are professed by whole sects.

V. They who attack our religion, found their opinions, either on the interpretation of the sacred text, or on philosophy, or history; and we should always oppose them with the same arms with which they pretend to defeat us. It is necessary to begin by divesting ourselves of all prejudice, in order the better to shew others those prejudices by which they are deluded. We should never make use, but especially when we oppose weak minds, of opprobrious terms in the course of the debate, nor contend about words or expressions, nor attack incidental circumstances that may attend erroneous principles; but bend our whole force against the root of the tree, the principal error; to uncover it, to dig it up, to destroy it.

VI. Polemic theology is taught in universities by two methods, according to the views of the student. If he learn it merely in order hereafter to defend his parishioners against the most prevalent errors, he is only to examine the principal controversies according to the systematic order of theology: and may content himself with knowing their true meaning, together with the arguments of those that oppose them. But if it be his intention to teach this science to others, or to engage in controversy, either by conversation or writing: in short, if he aspire to renown in it, he should study the origin and history of each controversy, he should make himself a complete master of the arguments for and against it, the exceptions that it makes, its interests, its different revolutions and actual state, &c. These follow, in this study, either the order established in the dogmatic, or that which is used in symbolic books, that is, such as treat on articles of faith.

VII. In order the better to elucidate the method to be observed in this sort of study, we shall say, that to acquire a complete knowledge of theological disputes, the student should, 1. Make the examen of each religion, and even of each controversy. 2. He should thoroughly examine his system in the symbolic books, and likewise the sources of his religion. 3. He should precisely determine the principal and capital error of each religion, sect, or individual; that which is the source from whence all the other errors flow. 4. Search into the political causes of each error, and

each controversy, from history. 5. Examine the natural order according to which all the errors have taken their rise, the one from the other: and lastly, 6. Confront the respective arguments, the answers, and exceptions, that each party has made to defend its cause. To all this is to be added, 7. What they call *Collegium disputatorium*; an exercise, by which all that is learned in the closet and in the schools is called forth and animated, under the inspection of a professor; and the mind is accustomed to think, and the tongue to speak, with facility and efficacy.

VIII. The principal contests in which the theologian may be engaged, are, 1. Against those who admit of no revealed religion; as the atheist and deist. 2. Against those who admit of a revealed religion, but adopt not the true Revelation; as the Heathens, the Mahometans, &c. 3. Against those who believe only a part of the true Revelation; as the Jews. 4. Against those who add to the true Revelation matter foreign to it; as traditions, &c. 5. Against those who make a false interpretation of the sacred text, and draw from it erroneous systems; as the heretics and the schismatics, &c. And lastly, 6. Against those who make a wrong use of certain expressions of Revelation, and build, on whimsical notions, ridiculous systems; as the Fanatics, Quakers, &c.

IX. According to this division, the theologian will have to combat principally with,

1. The Atheists, with Spinoza at their head.
2. The Deists.
3. The Heathens and Idolaters.
4. The Mahometans.
5. The modern Jews.
6. The Arians and Manicheans, or rather those who in these days follow their ancient errors.
7. The Socinians.
8. The Catholics, opposed to the Protestants.
9. The Protestants, opposed to the Catholics.
10. The Molinists, opposed to the Jansenists.
11. The Jansenists, opposed to the Molinists.
12. The Reformed, opposed to the Lutherans.
13. The Lutherans, opposed to the Reformed.
14. The Arminians.
15. The Anabaptists.
16. The Weigelians.
17. The Quakers or Tremblers.
18. The Fanatics, at the head of whom is Jacob Bohm.
19. The pretended new Prophets.
20. The Indifferents.
21. The Pietists.
22. The Moravian Brethren, or the Herenhutens, &c.

X. Now, as each of the religions, communions, or heresies above mentioned, have not scrupled to publish to the world their dogmas and creeds, the theologian ought carefully to instruct himself in those symbolic books, in which each of them have comprised its system; to study and to make a good analysis of them; and to prepare such arguments as are the most just, the most weighty, and proper to confute them.

XI. Before we quit this subject, there is one remark to be made, or rather one caution that is very essential, which we would offer to the young theologian; which is, that the polemic is useful, and even necessary in the study of theo-

logy in general; but that it is a discipline which ought to be treated with great prudence and moderation. Disputation in general is a dangerous art; and religious disputation is a deceitful art, and of infinite peril. The student will do right well to remember, that there is no sect, no communion on earth, that is perfectly true in all its dogmas without exception; that there are some small errors in all religions; that infallibility never was, nor ever will be, the portion of humanity. He should likewise remember, that the masters who teach him, or the books that he reads, are constantly partial to the religion they profess: and that when he has supported a thesis, and confuted his adversaries in a collegial dispute (where his adversaries, as well as his preceptors, are of the same side of the question, and will not fail to adjudge him the victory,) he should be persuaded, that the victory would not have been so easily obtained had he contended with able adversaries of the opposite religion: he should remember, that we triumph without glory when we combat without danger; and let him not be vain of his laurels, nor imagine himself some wonderful scholar; seeing that it is very possible, that he may go off victorious from such a dispute, that he may receive vast applause from his professors and his colleagues, and at the same time have reasoned like a dolt.

XII. On the other hand, the most able theologians, and the most consummate professors in this science, ought to be constantly on their guard against the abuse of polemic theology; which frequently serves less to clear and confirm the truth of the dogmas of a communion, than to establish perpetual discord and hatred among Christians. Every theologian should also remember, that by the nature of the subject, it is not possible to produce *demonstration* in support of his theses and opinions; but that his arguments will be only valid, and preponderate in proportion to their degree of evidence; and lastly, that it is a ridiculous and insufferable vanity to imagine, that every man, who does not think precisely as we do, is guilty of palpable error.

#### PASTORAL THEOLOGY.

I. HAVING described the theoretic sciences of theology, we now come to those which regard the practice. It would be to bury the talents that God has given him, and the studies that he has made, if the theologian did not employ them to the edification of his neighbour, and the prosperity of the Church. His office in society is attended with constant and anxious labours. He is charged with the *cure of souls*, with the instruction of youth, with preaching of the Gospel, the conduct of his flock, and the administration of the Sacraments, with visitations to the sick and the dying, with calming the terrors of weak minds, with administering comforts to afflicted souls, and many other functions equally difficult and important. The practical sciences that we shall here describe, will serve him as guides in this unbounded field.

II. Pastoral theology is usually divided into three parts; which are,

1. Homiletic Theology.
  2. Catechetic Theology.
  3. Casuistic Theology.
- To which are added,
4. The Consistorial Prudence.
  5. The prudential Exercise of the different functions of the ministry.

As the homily makes a part of eloquence, it is unnecessary to say any thing of it in this place, but treat the others in their order.

III. It is in vain that a son of the church possesses all the sciences that belong to his profession, that he is an agreeable and even a renowned preacher, if he do not give a life, an efficacious spirit, to his ministry, by a *good example*; for that is the first precept in pastoral theology. He is at the head of a flock, and ought to be their guide: but how absurd, if his words and his actions be at continual variance with each other! How scandalous, if he be not the first to practise these lessons of wisdom that he preaches! How indecent, if, while he edifies by his discourses, he disgusts by his morals! What baseness, if he should even glory in his irregularities! It is less shameful for a soldier to relate that he has tamely suffered an affront, than for an ecclesiastic to boast of his debaucheries! Both the one and the other is a disgrace to his profession.

IV. But this exemplary conduct should be free from all affectation in the external behaviour. A singularity of dress, and an air of austerity; the head declined, the eyes turned up to heaven, the hands constantly clasped, a plaintive tone of voice, and a solemn gait; a scrupulosity in things indifferent, and a dogmatic and clerical manner of deciding in the common affairs of life; a ridiculous inclination to discover iniquity in innocent actions; to confound pleasure with vice, and to be an enemy to joy, the greatest boon that God has bestowed on man; and a hundred other like fopperies there are, with which the religious make a parade, that is shocking both to good sense and the evangelic morality, and which render their ministry, in the eyes of sensible people, more contemptible than respectable. These are rocks on which the young theologian is much too liable to run, and of which he cannot be sufficiently cautioned.

V. After this candid caution, and brief introduction, we pass to the examen of the different parts, the union of which composes the system of the pastoral, the most important article perhaps, in all theology. The design of Revelation was, without doubt, to conduct man by faith to a virtuous life. It is not the opinions or the learning of weak mortals that can determine their intrinsic merit; it is their wisdom, their regularity of conduct, that must stamp their value. Experience shews, that a man of great genius and learning may be also a great villain; one who is unable to please God, or his neighbour: the virtuous Christian, on the contrary, must be agreeable to both; it follows therefore, that the practical part of theology, which leads mankind to a virtuous conduct, is of all its parts the most important.

#### CATECHETIC THEOLOGY.

I. By Catechetical Theology is meant, *The art of teaching youth, and ignorant persons, the principal points of the Evangelical Doctrine, as well with regard to belief as practice.* This application of the theoretic sciences of theology ought to be conducted in the most simple manner possible. It is not every one who is possessed of the talent of properly composing and delivering catechetical instructions; and it is an art that is very necessary in the Christian church.

II. The greatest difficulty consists in separating the articles of faith that are absolutely essential and indispensable to the salvation of mankind, from those that are subtle and speculative, more liable to contradiction, and less necessary

to such as do not make theology their profession. However, as children do not always remain children, and as the church is composed of persons of both sexes, and of all ages, it is necessary, that, in the explanations of the catechism, there should be employed different degrees of simplicity, proportioned to the age and capacity of those that are to be instructed. It is expedient for young people to retain in their minds the first principles of religion, such as are contained in good catechisms; and that they be explained to them in particular lectures; which is the most usual and most natural method of enabling youth to give an account of their faith. The sermons that are given in the catholic churches on controversy, and in protestant churches on the catechism, serve to instruct those who are of riper years and have their judgment more formed. These sermons compose, at the same time, a sort of course of the dogmatic and the polemic theology.

III. Both in private catechising, and in sermons that are purposely intended to explain the catechism, the theologian should avoid, as much as possible, the use of technical terms; or (which is still better) he ought to begin by explaining those terms, of which he should give such clear and determinate definitions, that no person of a moderate capacity can possibly mistake them. In a word, he should endeavour more to prove than to persuade; and as eloquence sometimes persuades at the expence of truth, he should cautiously avoid that sort of delusive persuasion, and in its room substitute clear and solid argument.

IV. The catechumen should not only be instructed in the tenets of his own religion, and the foundations on which they are built, but also in the dogmas of other religions, and the proofs that are brought to maintain them: for a subtle, deceitful and specious book may fall into his hands, or he may be drawn into a dispute with an able adversary. It is necessary, therefore, that he be provided with arms offensive and defensive, that he may be able successfully to defend himself; and, if it may be, to convert his antagonist, and by that mean promote the glory of truth and of religion. It is the part, therefore, of his preceptor, to teach him faithfully the principal tenets of other religions, and the arguments that are brought to defend them.

#### Of CASUISTIC THEOLOGY.

I. HAPPILY for man, and for society, all are not so obstinate, or so insensible, as to ask, *what sort of animal conscience is, or never to know what is remorse.* Happily, the greatest part of mankind are sensible, that all their actions are not conformable to the laws of divine wisdom, nor to the rules of natural equity; are afflicted at their past conduct, and find a generous and earnest desire arise in their souls to avoid for the future those dangerous rocks. To calm the troubled mind; to appease the timorous conscience; to communicate the consolations of grace to the afflicted soul; to explain and decide in doubtful cases; to direct those that err, and to support their weakness; to convince such as persist in their errors; to pierce the hardened heart; to intimidate the wicked, and to rouse the indolent; to conduct the Christians, committed to the care of their pastor, in the way that leads to true felicity; are the important objects of casuistic theology, and for which it affords the proper instructions.

II. In a more confined sense, by casuistic theology is meant, the science that decides in doubtful cases of moral

theology, and that calms the scruples of conscience which arise in the Christian's soul during his sojourn in this world.

III. The studies relative to these objects, which the theologian is supposed to have made, and the confidence that the common rank of Christians place in their pastors, afford them the means and the opportunities of rendering signal service to those of their fellow citizens who have need of their counsel and consolation: for where there is one man of a philosophic spirit, one Christian of a well-grounded knowledge in theology, there are in a society a thousand that are not, and who are yet desirous of being instructed, guided, comforted, established. It is therefore both just and important, that he who devotes himself to the service of the altar, should early study all those sciences that will enable him worthily to perform this important part of his ministry.

IV. God forbid, however, that we should countenance the abuse that is made, in some Christian countries, of the duties that we have here explained. To reduce these matters into a political system; to make the direction of consciences a profession, a regular trade; to provide each house with a spiritual director, as with a butcher or baker, a steward or porter, who by that mean may insinuate himself into the confidence of families; and become the depository of all their secrets; may sometimes sow discord between husband and wife, or the nearest relations; who may avail himself of the confidence of his devotees, to direct them constantly in matters of a worldly, and sometimes even of a criminal nature; to efface the legitimate and sacred authority of the father of a family, and, in its place, to substitute a foreign power; to undermine the confidence, the union and concord of families, in order to confirm and render necessary this secondary authority; to captivate the spirit, and oft-times the heart of a wife or daughter, and in general of weak minds; to enjoin them ridiculous mummeries that lead to fanaticism, and a thousand dangerous superstitions, or to religious exercises that divert them from their domestic duties; in a word, to assume an absolute authority over the consciences of mankind, is a pernicious invention, contrary to the evangelic moral, to the welfare of society, to the interest of the state, and to the sovereign authority; and well deserves an exemplary punishment.

V. But the cure of souls, faithfully intended, and properly limited, differs totally from this despotic power. He, who is charged with it by a lawful vocation, should remember that there are four classes of men with whom he will be engaged: 1. With those of weak minds; of little knowledge, and little ability. 2. With those whose spirits are afflicted by some great reverse of fortune. 3. With those of nice and timorous consciences, who suffer by their scruples, whether they be vain or rational. 4. And lastly, the wicked, the hardened and incorrigible sinner. The grand art here consists in representing to each of these classes of men, the truth, in a manner so clear, so strong and full, that they can no longer retain any doubts, that conviction must take place, and consolation or conversion be the consequence.

VI. Truth is in its nature highly problematic: each one, however, is persuaded that he knows it, that he possesses it, and is guided by it; every man thinks himself in the right. We should therefore begin by discovering the truth in the subject before us, and in placing it upon a solid foundation. This business of demonstrating the truth to others, is attended in the mean time with infinite diffi-

culty. Every mind is not capable of discovering it at the first glance; nor can all discern it from the same point of view. Sometimes men require conviction by abstract or philosophical arguments, and sometimes by the express decisions of the Holy Scripture. Sometimes by authority, sometimes by gentle remonstrance, and sometimes by dreadful menaces. Sometimes they are to be reclaimed by properly exposing the necessary and fatal consequences that result from their conduct; and at others, by the alluring promises of the Gospel. Now vice is to be boldly confronted; and now the transgressor is to be conducted into the right path by artful turnings: now the sinner's crimes are to be painted in the strongest colours; and now a veil is to be lightly cast over them; and sometimes we should even indulge a favourite inclination, in order to induce them to abandon a more pernicious passion: and so of the rest.

VII. As it is impossible that the books which have been wrote on this subject, though of an immense quantity, can contain every case that daily occurs in the ministry of the Gospel; and as these cases are not always justly decided by these authors; and, if they were, the consulting of such enormous works would take up too much of a theologian's time, and divert him from his other studies; and as these casuistic writers contain, moreover, a number of puerile subtilties, and wretched chimeras; it is highly proper that the minister of the altar, whom we suppose to have a masterly knowledge of the principles, the dogmas, and moral of the Christian religion, should endeavour to draw from the true source the means that he is to employ on each occurrence, and not have recourse to books for their decisions. For which purpose it is necessary, 1. That he accustom himself to reason according to the rules of sound logic. 2. That he learn to know the human heart, under its different disguises; the characters of men, their arts, and ruling passions. 3. That he do not attempt to gain or convince by little pious frauds, or by lucky sophisms artfully represented. 4. That he do not inflict what are called penances, which are the height of absurdity. 5. That he do not enjoin mummeries, pilgrimages, austerities, and a thousand like matters, which can never carry with them a real conviction; and only serve to divert men from their labours and the duties of society. But, 6. That he constantly present, as we have before said, and cannot too often repeat, the truth, in all its native force and purity.

VIII. This truth, however, is no enemy to sacred eloquence; on the contrary, the latter serves to introduce the former into the mind of the auditor, and there to give it such strong impressions, as neither time, the dissipations of the world, nor the distractions of fortune, are able easily to efface. The whole ministerial function consists in teaching, preaching, administering the sacraments of the church, visiting the sick and the dying, comforting the afflicted, and affording the spiritual aids to all those who have need of them. Eloquence is of the greatest efficacy in all these functions; and, without affecting it, the minister of the gospel should never neglect it. There are some professors in universities who give their auditors a complete systematic course on pastoral theology, which may be attended with many advantages.

CONSISTORIAL PRUDENCE, or GENERAL OECONOMY  
of the Church.

I. AMONG the practical sciences of theology, we must

not pass over in silence that which is called the Consistorial or Ecclesiastic Prudence; whose object is the exterior order or arrangement of the Christian church, on principles founded on the Holy Scriptures; and which are proper, not only to maintain religion in its purity and splendor, but to defend it against all schisms, dissensions and separations whatever. This œconomy is necessary in the councils, the synods, the consistories, and in the faculties of theology. We must not, however, confound this with the ecclesiastic jurisprudence, which is the science of interpreting and applying the laws, instituted by the sovereign, relative to the persons, goods, and affairs of the church; whereas the object of consistorial prudence is the arrangement of the church itself, and the ecclesiastic state, on Christian and rational maxims. The one is a sort of legislation in itself; and the other, on the contrary, an application of the civil laws.

II. The theological prudence includes therefore, first, the whole plan of church-government, and the arrangement of the ecclesiastic state; secondly, the ordinances relative to exterior ceremonies, and divine worship; and lastly, the discipline of the church; the errors, the schisms, the heresies, and dissensions that arise among Christians. The source of this prudence is a thorough knowledge of the essence of the Christian religion, and the method of drawing from it just consequences.

III. This discipline is likewise employed in deciding, Wherein consists the difference between the clergy and the laity; or if there be, in fact, any real difference between them: if the church form a distinct state in the general system of government; and to whom belongs the right of deciding *circa sacra*; and what are the limits of the spiritual and temporal powers in this respect: wherein consists the hierarchy of the church, and what are its rights and privileges: to whom appertains the nomination of a priest, or other ecclesiastic, according to the divine ordinance: to whom is committed the right of preaching in public, of administering the sacraments, and of exercising the excommunicative power of expelling, or again admitting, any particular Christian, or even a whole country, into the pale of the church: the bans and interdicts; the exercise of sacred or theologic studies; the schools, the seminaries, the universities and academies, the classes, the convents; and so of the rest: all subjects vigorously attacked and obstinately defended.

IV. The consistorial prudence examines likewise the liturgies, the ceremonies and religious customs; the breviaries, the rituals, the canticles, and other books of devotion adopted by the church; the formularies, the subjects of discipline, &c. &c. the creeds, the confessions of faith, the catechisms, and many other like matters; and lastly, the doubts and objects of controversy, that occasion the holding of synods and councils; the question, if the Pope be above the councils, or the councils above the Pope; the practice of elenchic theology, or the public elenchy; the separation and reunion of the church, which the Syncretists and Irenians dispute; the divorces more or less allowable; matrimonial, and consistorial matters, &c. &c.

V. All these subjects, and an infinity of others, which arise from, or have an immediate connection with these, require to be thoroughly considered, reduced into a regular system, explained and fixed on solid principles, and confirmed by just and pertinent examples. From all this results what is called Ecclesiastic Prudence. This science has

not yet been reduced into a system or formal discipline, and that principally because it has been constantly confounded with the ecclesiastic law: but that in reality differs as much from this, as political prudence differs from the common law.

*Of THEOLOGIC PRUDENCE in the DIFFERENT FUNCTIONS of the MINISTRY.*

I. INDEPENDENT of casuistical theology, and of the œconomy of the church in general, the theologian has, moreover, need of great sagacity in the particular exercise of his ministry; and many able divines have reduced this science into a system, and have given general precepts, and particular rules, for the conduct of the minister of the altar, in the different circumstances that may arise in this part of his duty. We shall decline the particular explanation of these different systems, as it would lead us into numberless *minutiæ*. *Conrad Porta* has wrote a work on the subject, intitled *Pastorale Lutheri*; *Stoltzelinus*, *Kortholt*, *Philip Hahn*, *Hartman*, and many other theologians, have wrote large volumes concerning it; but, above all, the treatise of *Dr. John Mayer*, which is called *Museum Ministri Ecclesiæ*, is to be consulted on this matter. We the more readily omit the names and titles of other works of this kind, as we have prescribed it to ourselves as a law, to avoid, as much as possible, these sorts of citations, seeing that the number of new books that are continually appearing frequently supersede their predecessors; and moreover, in this part of theology, each Christian communion has its particular authors, who treat it in conformity to the dogmas and principles which that communion adopts.

II. The humour of reducing every thing into system, has also taken place in this matter, which in fact appears to have no occasion for any peculiar discipline that could not be included under some other part of theology. But as this distinction is already made, it is our business to explain it, for the use of such as devote themselves to the altar. The prudential theology is, for them and their ministry, what political prudence is for a man of the world in the commerce of life. It is the art of attaining the end proposed: and as each condition in life has its particular pursuits, the divines have also naturally theirs, and the precepts of theologic prudence serve to conduct them to it.

III. But as the dogmas, the ceremonies, the rites and objects that the ministers of the different Christian communions propose to themselves, are by no means the same, each communion, each sect, does not follow, in this respect, the same rules and precepts, nor even part of the same principles. All that we can therefore do amidst this diversity of opinions, and contrariety of maxims, is to point out, in a few words, the principal objects that one or other of them comprehend in this part of their pastoral theology.

IV. The *Ascetic Theology*, for instance, treats of the various particular exercises of piety; and the principles, that it proposes with this regard, serve as guides to the minister of the altar, in his recommendation of the practice of it, as well as in many parts of his ecclesiastic duty. Fasts, pilgrimages, and many other matters of the same kind, belong to the province of ascetic theology, and which we will not absolutely reject, because we write for readers of all sorts of communions. Truth, however, obliges us to remark, that the ascetic theology of every communion is the offspring of principles falsely attributed to the Gospel, and belongs

belongs much more properly to superstition than religion. The monastic life, of which there is not the least trace to be found in the Holy Scriptures, and which is so contrary to the wisdom and goodness of God; the contemplative life which is employed merely in theoretic and barren speculations, and which is a continual impediment to the practice of the duties of a citizen, and of the social virtues; the corporal chastisements that the pious visionary inflicts on himself, and a thousand like absurdities, are the fruits of fanaticism, and the essence of ascetic theology.

V. Under this head may be also included, confession and absolution, which are modern inventions, and of which there is not the least vestige to be found in the Gospel, and which were unknown to Jesus Christ and his apostles; unless we would torture and disguise the text, and make a strange abuse of words, and of phrases the most simple: inventions, in short, that are more politic and lucrative than divine. Be that as it may, the ascetic theology prescribes general maxims relative to confession and absolution, and particular precepts for the priests of the confessional.

VI. The *Paracletic Theology*, on the contrary, is totally employed in preparing consolations against plagues and other public calamities and adversities, and against the most considerable evils that befall individuals. It considers, examines, and directs these consolations, and points out the proper method of applying them. As it is the business of ascetic theology to humble and intimidate the Christian, and to subject him to all sorts of pious and painful bodily exercises, so it is that of paracletic theology to reanimate his courage and his faith, and to administer consolation to his soul.

VII. The five doctrines of which we have here treated, to wit, the Homilitic, Catechetic, and Casuistic Theology, and the Consistorial and Theologic Prudence in the ordinary exercise of the ministry, form therefore what is called, in

a collective sense, *Pastoral Theology*; a science on which many authors, of all communions, have wrote vast treatises; in which complete courses are made at universities, by the faculties of theology; which is reduced into a regular system; and which, in fact, forms not one of the least parts of that science which is necessary to an able and faithful theologian who undertakes the cure of souls.

VIII. We think we have said enough to give an idea of those sciences that compose the general system of theology. We are not ignorant, however, that there are theologies established in the schools, still different in their genus and species: that they distinguish, for example, 1. The Theology of God, (*Theologia Dei*), 2. That of Jesus Christ, 3. That of the Holy Ghost, 4. That of Angels, and 5. That of Men: that they again sub-divide the Theology of God, 1. Into *Theologia Dei naturalis*, or *essentialis*, by which is shewn, that God perceives *semel et semel*, once and for ever, all that is contained in his essence; and 2. *Theologia Dei idealis* or *exemplaris*, which considers those things that must be revealed to mankind to work their salvation: this last article is again, divided into *Archetypic Theology*, which teaches what comes, in this respect, immediately from God himself; and *Ectypic Theology*, which considers the theologic notions that man, as the image of God, is able to acquire by his own nature, that is, by the ability he has received from the Supreme Being, to know and adore him, and by the preaching of his divine word. But we should never have done, were we to relate all the distinctions, divisions, and subdivisions, &c. that men, fond of systematic forms, have introduced into all the sciences: divisions whose whimsical denominations busy and embarrass the mind that ought to be more usefully employed in attending to realities; and which constantly favour of that pedantry which insinuates itself, more or less, into the study of every science.

## R E M

REMEMBRANCE. See MEMORY.

REMEMBRANCERS, anciently called clerks of the remembrance, certain officers in the exchequer, whereof three are distinguished by the names of the king's remembrancer, the lord treasurer's remembrancer, and the remembrancer of the first fruits. The king's remembrancer enters in his office all recognizances taken before the barons for any of the king's debts, for appearances or obferving of orders; he also takes all bonds for the king's debts, &c. and makes out processes thereon. He likewise issues processes against the collectors of the customs, excise, and others, for their accounts; and informations upon penal statutes are entered and sued in his office, where all proceedings in matters upon English bills in the exchequer-chamber remain. His duty further is to make out the bills of compositions upon penal laws, to take the statement of debts; and into his office are delivered all kinds of indentures and other evidences which concern the assuring any lands to the crown. He, every year in *crastino animarum*, reads in open court the statute for election of sheriffs; and likewise openly reads in court the oaths of all the officers, when they are admitted.

The lord treasurer's remembrancer is charged to make out process against all sheriffs, escheators, receivers, and bailiffs, for their accounts. He also makes out writs of

## R E M

*fieri facias*, and extent for debts due to the king, either in the pipe or with the auditors; and process for all such revenue as is due to the king on account of his tenures. He takes the account of sheriffs; and also keeps a record, by which it appears whether the sheriffs or other accountants pay their proffers due at Easter and Michaelmas: and at the same time he makes a record, whereby the sheriffs or other accountants keep their prefixed days: there are likewise brought into his office all the accounts of customers, comptrolers, and accountants, in order to make entry thereof on record: also all estreats and amerccements are certified here, &c.

The remembrancer of the first-fruits takes all compositions and bonds for the payment of first-fruits and tenths; and makes out process against such as do not pay the same.

REMINISCENCE, that power of the human mind, whereby it recollects itself, or calls again into its remembrance such ideas or notions as it had really forgot; in which it differs from memory, which is a treasuring up of things in the mind, and keeping them there, without forgetting them.

REMISSION, in physics, the abatement of the power or efficacy of any quality.

REMISSION, in law, &c. denotes the pardon of a crime, or the giving up the punishment due thereto.

RE-

**REMITTANCE**, in commerce, the traffic or return of money from one place to another, by bills of exchange, orders, or the like.

**REMONSTRANCE**, an expostulation or humble supplication, addressed to a king, or other superior, beseeching him to reflect on the inconveniences, or ill consequences of some order, or the like. This word is also used for an expostulatory counsel, or advice; or a gentle and handsome reproof, made either in general, or particular, to apprise or correct some fault, &c.

**REMORA**, in ichthyology. See **ECHENEIS**.

**ACTION OF REMOVING**, in Scots law. See **LAW**, Tit. xiii. 16.

**REMPLY**, in heraldry, something filled up. The term is chiefly used to denote that the chief is quite filled up with a square piece of another colour, leaving only a bordure of the proper colour of the chief about the said piece. See **PLATE CXLVII. fig. 8.**

**RENAL**, something belonging to the reins or kidneys. See **ANATOMY**, p. 268.

**RENCOUNTER**, in the military art, an engagement of two little bodies or parties of forces; in which sense it stands in opposition to a pitched battle. See **BATTLE**.

**RENCOUNTRE**, or **RENCONTRE**, in heraldry, is applied to animals when they shew the head in front, with both eyes, &c. or when the face stands right forward, as if they came to meet the person before them.

**RENDEZVOUS**, a place appointed to meet in at a certain day an hour.

**RENEALMIA**, in botany. See **TELLANDSIA**.

**RENEGATE**, or **RENEGADO**, a person who has apostatized or renounced the Christian faith, to embrace some other religion, particularly Mahometanism.

**RENFREW**, a town of Scotland, the capital of the county of Renfrew, situated on the river Clyde, forty-six miles west of Edinburgh.

**RENIFORM** something resembling the figure or shape of kidneys.

**RENITENCY**, among philosophers, that force in solid bodies, whereby they resist the impulse of other bodies or re-act as much as they are acted on. See **MECHANICS**.

**RENNES**, a city of France, capital of the province of Brittany, situated on the river Villaine: W. long. 1° 45', N lat. 48° 5'.

**RENT**, in law, a sum of money, or other consideration, issuing yearly out of lands or tenements.

**RENVERSE**, or **INVERTED**, in heraldry, is when any thing is set with the head downwards, or contrary to its natural way of standing. Thus a chevron renversé is a chevron with the point downwards. They use also the same term when a beast is laid on its back.

**RENUNCIATION**, the act of renouncing, abdicating, or relinquishing any right, real or pretended.

**RENUNCIATION by an heir**, in Scots law. See **ADJUDICATION**.

**REPARTEE** a ready smart reply, especially in matters of wit, humour, or raillery.

**REPEALING**, in law, the revoking or annulling of a statute, or the like.

**REPEAT**, in musick, a character shewing that what was last played or sung must be repeated or gone over again.

**REPELLENTS**, in medicine, remedies which drive back a morbid humour into the mass of blood from which it was unduly secreted.

The most remarkable in the class of repellents are the white of an egg, the lapis calaminaris, litharge of gum, red-lead, tully, pampolith, house-leek, putty, and cow web.

**REITERATION**, the reiterating of an action.

**REPETITION**, in rhetoric, a figure which gracefully and emphatically repeats either the same word, or the same sense in different words.

**REPLETION**, in medicine, a plenitude or plethora. See **PLETHORA**.

**Right of REPLEDGING**, in Scots law. See **Lord of REGALTY**.

**REPRESENTATION**, in the drama, the exhibition of a theatrical piece, together with the scenes, machines, &c. See **COMPOSITION**.

**REPRESENTATIVE**, one who personates or supplies the place of another, and is invested with his right and authority. Thus the house of commons are the representatives of the people in parliament.

**REPRIEVE**, in law, is suspending or deferring the execution of the law upon a prisoner for a certain time; or a warrant on the king for deferring the execution of a person condemned.

**REPRISALS** a right which princes claim of taking from their enemies any thing equivalent to what they unjustly detain from them.

**REPROBATION**, in theology, a decree by which God is supposed, either from all eternity, or from the creation of the world, to consign over to eternal misery the greatest part of mankind, and to save none of the human race, except those whom he made the heirs of glory by election.

**REPROBATOR**, in Scots law. See **LAW**, Tit. xxxi. 14.

**REPRODUCTION**, the act whereby a thing is produced anew, or grows a second time.

The reproduction of several parts of lobsters, crabs, &c. is one of the greatest curiosities in natural history. It seems, indeed, inconsistent with the modern system of generation, which supposes the animal to be wholly formed in the egg; that, in lieu of an organical part of an animal cut off, another should arise perfectly like it: the fact, however, is too well attested to be denied. The legs of lobsters, &c. consist each of five articulations; now when any of the legs happen to break, by any accident, as by walking, &c. which frequently happens, the fracture is always found to be at the future near the fourth articulation; and what they thus lose, is exactly reproduced in some time afterwards. that is, a part of the leg shoots out, consisting of four articulations, the first whereof has two claws, as before; so that the loss is entirely repaired.

If the leg of a lobster be broken off by design at the fourth or fifth articulation, what is thus broke off is always reproduced. But, if the fracture be made in the first, second, or third articulation, the reproduction is not so certain. And it is very surprising, that, if the fracture be made at these articulations, at the end of two or three days all the other articulations are generally found broke off to the fourth. which, it is supposed, is done by the creature itself, to make the reproduction certain. The part reproduced is not only similar to that retrenched, but also, in a certain space of time, grows equal to it. Hence it is that we frequently see lobsters which have their two large legs unequal in all proportions; and, if the part reproduced be broken off, a second will succeed.

- REPTILES**, in natural history, a kind of animals denominated from their creeping or advancing on the belly. Or reptiles are a genus of animals and insects, which, instead of feet, rest on one part of the body, while they advance forward with the rest.
- Such are earthworms, snakes, caterpillars, &c.
- REPUBLIC**, commonwealth, a popular state or government; or a nation where the people have the government in their own hands.
- REPUBLIC of letters**, a phrase used collectively of the whole body of the people of study and learning.
- REPUDIATION**, in the civil law, the act of divorcing. See **DIVORCE**.
- REPULSION**, in physics, that property in bodies, whereby, if they are placed just beyond the sphere of each other's attraction, they mutually fly from each other. See **ELECTRICITY**, and **MECHANICS**.
- REQUEST**, in law, a supplication or petition preferred to a prince, or to a court of justice, begging relief in some conſiderable caſes where the common law grants no immediate redreſs.
- Court of REQUESTS*, an ancient court of equity, inſtituted about the nineteenth year of Henry VII. See **COURT**.
- In the fortieth and forty-first years of queen Elizabeth, it was adjudged upon ſolemn argument, in the court of common pleas, that the court of request was then no court of equity.
- REQUIEM**, in the Romiſh church, a maſs ſung for the reſt of the ſoul of a perſon deceaſed. See **MASS**.
- REQUISITION**, in Scots law. See **LAW**, Tit. xv. 8.
- RESARCELE'E**, in heraldry, is where a ſlender croſs is charged upon another, as repreſented in Plate CXLVII. fig. 6.
- RESCHET**, the capital of the province of Gilan, in Perſia, ſituated on the ſouth-weſt coaſt of the Caſpian ſea.
- RESCISSION**, in the civil law, an action intended for the annulling, or ſetting aſide, any contract, deed, &c.
- RESCRIPT**, an answer delivered by an emperor, or a pope, when conſulted by particular perſons, on ſome difficult queſtion or point of law, to ſerve as a deciſion thereof.
- RESEDA**, in botany, a genus of the dodecandria trigynia claſs. The calix conſiſts of one deeply cut leaf; the petals are lacinated; and the caſule has one cell. There are 11 ſpecies, two of them natives of Britain, *viz.* the lutea, or baſe-rocket; and the luteola, wild wood, or dyers-weed.
- RESERVATION**, in law, an action or claule whereby ſomething is reſerved, or ſecured to one's ſelf.
- Mental RESERVATION*, a propoſition, which, ſtrictly taken, and according to the natural import of the terms, is falſe; but, if qualified by ſomething concealed in the mind, becomes true.
- Body of RESERVE*, or *Corps de REſERVE*, in military affairs, the third or laſt line of an army, drawn up for battle; ſo called becauſe they are reſerved to ſuſtain the reſt, as occaſion requires; and not to engage, but in caſe of neceſſity.
- RESERVOIR**, a place where water is collected and reſerved, in order to be conveyed to diſtant places through pipes, or ſupply a fountain, or jet d'eau.
- RESET OF THEFT**, in Scots law. See **LAW**, Tit. xxxiii. 29.
- RESIDENT**, a public miniſter, who manages the affairs of a kingdom or ſtate, at a foreign court.
- They are a claſs of public miniſters inferior to ambaffadors or envoys; but, like them, are under the protection of the law of nations.
- RESIDUE**, the remainder or balance of an account, debt, or any thing elſe.
- RESIN**. See **CHEMISTRY**, p. 94.
- RESIGNATION**, in Scots law. See **LAW**, Tit. xiv. 7.
- RESISTANCE**, or **RESISTING FORCE**, in philoſophy, denotes, in general, any power which acts in an oppoſite direction to another, ſo as to deſtroy or diminiſh its effect. See **MECHANICS**, **HYDROSTATICS**, and **PNEUMATICS**.
- RES JUDICATA**, in Scots law. See **LAW**, Tit. xxxii. 4.
- Res Publica*, in Scots law. See **LAW**, Tit. viii. 2.
- Res Univerſitatis*, in Scots law. See **LAW**, *ibid.*
- Res Sacra*, in Scots law. See **LAW**, *ibid.*
- RESOLUTION**, in chemiſtry, &c. the reduction of a mixed body into its component parts, or firſt principles, by a proper analysis. See **CHEMISTRY**, p. 100.
- RESOLUTION**, in medicine, that coction or alteration of the crude peccant matter of any diſeaſe, either by the natural ſtrength of the patient, or of its own accord, or by the application of remedies, whereby its bulk, figure, coheſion, &c. are ſo far changed, as that it ceases to be morbid, and becomes laudable.
- RESOLVENTS**, in medicine, remedies proper to reſolve and diſſipate tumours and gatherings, to ſoften indurations, and, by their tenuity and warmth, evacuate redundant and peccant humours through the pores. Under this claſs come various unguents, emplaſters, &c.
- RESONANCE**, **REOUNDING**, in muſick, &c. a ſound returned by the air, incloſed in the bodies of ſtringed muſical inſtruments, as lutes, &c. or even in the bodies of wind inſtruments, as flutes, &c. See **MUSICK**, and **PNEUMATICS**.
- RESPIRATION**, the act of reſpiring or breathing the air. See **ANATOMY**, p. 281.
- RESPITE**, in law, &c. ſignifies a delay, forbearance, or prolongation of time, granted any one, for the payment of a debt or the like.
- RESPONDENT**, in the ſchools, one who maintains a theſis, in any art or ſcience; who is thus called, from his being to answer all the objections propoſed by the opponent.
- RESPONSE**, an answer or reply. A word chiefly uſed in ſpeaking of the answers made by the people to the prieſt, in the litany, the pſalms, &c.
- RESSAULT**, in architecture, is the effect of a body which either projects or ſinks back; that is, ſtands more out or in than another, ſo as to be out of the line or level with it.
- RESSORT**, a French word, ſometimes uſed by Engliſh authors, to ſignify the juriſdiction of a court, and particularly one from which there is no appeal.
- Thus it is ſaid, that the houſe of lords judge en dernier reſſort, or in the laſt reſſort.
- REST**, the continuance of a body in the ſame place, or its continual application or contiguity to the ſame parts of the ambient or contiguous bodies; and therefore is oppoſed to motion.
- REST**, in poetry, is a ſhort pauſe of the voice in reading, being

being the same with the *cæsura*, which, in alexandrine verses, falls on the sixth syllable, but in verses of ten or eleven syllables, on the fourth.

**RESTAURATION**, the act of re-establishing or setting a thing into former good state.

**RESTITUTION**, in a moral and legal sense, is restoring a person to his right; or returning something unjustly taken or detained from him.

**RESTITUTION of medals**, or **RESTITUTED MEDALS**, is a term used by antiquaries, for such medals as were struck by the emperors, to retrieve the memory of their predecessor.

Hence, in several medals we find the letters **REST**. This practice was first begun by Claudius, by his striking afresh several medals of Augustus. Nero did the same; and Titus, after his father's example, struck restitutions of most of his predecessors. Gallienus struck a general restitution of all the preceding emperors, on two medals, the one bearing an altar, the other an eagle, without the **REST**.

**RESTIVE**, or **RESTY**, in the manege, a stubborn, unruly, ill-broken horse, that stops, or runs back, instead of advancing forward.

**RESTORATION**, the same with *restauration*. See **RESTAURATION**.

In England, the return of king Charles II. in 1660, is, by way of eminence, called the *Restoration*; and the 29th of May is kept as an anniversary festival, in commemoration of that event, by which the regal and episcopal government was restored.

**RESTORATIVE**, in medicine, a remedy proper for restoring and retrieving the strength and vigour both of the body and animal spirits.

All under this class, says Quincy, are rather nutritional than medicinal; and are more administered to repair the wastes of the constitution, than to alter and rectify its disorders.

**RESTRICTION**, among logicians, is limiting a term, so as to make it signify less than it usually does.

**RESTRINGENT**, in medicine, the same with *astringent*. See **ASTRINGENTS**.

**RESULT**, what is gathered from a conference, inquiry, meditation, or the like; or the conclusion and effect thereof.

**RESURRECTION**, in theology, rising again from the dead; or a person's returning to a second life, with new bodily organs, adapted to the state of its new existence.

One of the greatest arguments for the truth of Christianity is drawn from the resurrection of our Saviour; the circumstances of which are handed down to us in so plain and distinct a manner by the evangelists, as make the evidence of this important truth amount to a demonstration.

Christians generally believe, that at the day of judgement, the very identical body they have now, with the same flesh, blood, and bones, will be raised from the dead.

**RESUSCITATION**, the same with *resurrection* and *revivification*. See the preceding article.

The term *resuscitation* however, is more particularly used by chemists, for the reproducing a mixed body from its ashes, an art to which many have pretended, as to reproduce plants, &c. from their ashes.

**RETAIL**, in commerce, is the selling of goods in small parcels, in opposition to wholesale. See **COMMERCE**.

**RETAINER**, a servant who does not continually dwell in the house of his master, but only attends upon special occasions.

**RETAINING FEE**, the first fee given to a serjeant or counsellor at law, in order to make him sure, and prevent his pleading on the contrary side.

**RETALIATION**, among civilians, the act of returning like for like.

**RETARDATION**, in physics, the act of diminishing the velocity of a moving body. See **MECHANICS**.

**RETE MIRABILE**, in anatomy, a small plexus, or network of vessels in the brain, surrounding the pituitary gland. See **ANATOMY**, p. 286.

**RETENTION**, is defined, by Mr Locke, to be a faculty of the mind, whereby it keeps, or retains, those simple ideas it has once received, by sensation or reflection. See **METAPHYSICS**.

**RETENTION** is also used, in medicine, &c. for the state of contraction in the solids or vascular parts of the body, which makes them hold fast their proper contents. In this sense, retention is opposed to evacuation and excretion.

**RETIARI**, in antiquity, a kind of gladiators, thus denominated from a net which they made use of against their antagonists, who were called *secutores*, and sometimes *mirmillones*.

This net they carried under their buckler, and when opportunity served, cast it over the head of their antagonist, and in this condition killed him with a trident which they bore in the other hand.

**RETFORD**, a borough-town of Nottinghamshire, situated twenty-five miles north of Nottingham. It sends two members to parliament.

**RETICULA**, or **RETICULE**, in astronomy, a contrivance for the exact measuring the quantity of eclipses.

The reticule is a little frame, consisting of thirteen fine silken threads, equidistant from each other, and parallel, placed in the focus of object-glasses of telescopes; that is, in the place where the image of the luminary is painted in its full extent: of consequence, therefore, the diameter of the sun or moon is hereby seen divided into twelve equal parts or digits; so that, to find the quantity of the eclipse, there is nothing to do but to number the luminous and dark parts. As a square reticule is only proper for the diameter, not for the circumference, of the luminary, it is sometimes made circular by drawing six concentric equidistant circles. This represents the phases of the eclipse perfectly.

**Corpus RETICULARE**, in anatomy. See **ANATOMY**, p. 255.

**RETINA**, in anatomy. See **ANATOMY**, p. 289.

**RETIINUE**, the attendants or followers of a prince or person of quality, chiefly in a journey.

**RETIRADE**, in fortification, a kind of retrenchment made in the body of a bastion, or other work, which is to be disputed, inch by inch, after the defences are dismantled. It usually consists of two faces, which making a re-entering angle, when a breach is made in a bastion, the enemy may also make a *retirade* or new fortification behind it.

**RETILINGEN**, an imperial city of Germany, in the circle

- of Swabia and duchy of Wirtemberg, situated in E. long. 10°, N. lat. 48° 18'.
- RETORT**, in chemistry. See **CHEMISTRY**, p. 110.
- RETRACTS**, among horsemen, pricks in a horse's feet, arising from the fault of the farrier in driving nails that are weak, or in driving them ill pointed, or otherwise amiss.
- RETRENCHMENT**, literally signifies something cut off or taken from a thing; in which sense it is the same with subtraction, diminution, &c.
- RETRENCHMENT**, in the art of war, any kind of work raised to cover a post, and fortify it against the enemy, such as fascines loaded with earth, gambions, barrels of earth, sand-bags, and generally all things that can cover the men and stop the enemy. See **FORTIFICATION**.
- RETRIBUTION**, a handsome present, gratuity, or acknowledgment, given instead of a formal salary or hire to persons employed in affairs that do not so immediately fall under estimation, nor within the ordinary commerce in money.
- RETROCESSION**, the act of going backwards; more usually called retrogression, or retrogradation. See the next article.
- RETROCESSION of the equinox**. See **ASTRONOMY**, p. 562.
- RETROGRADATION**, the act or effect of a thing moving backwards.
- Retrograde motion of the planets. See **ASTRONOMY**, p. 448.
- RETROMINGENTS**, in natural history, a class or division of animals, whose characteristic it is that they stale, or make water, backwards, both male and female.
- REVE**, **REEVE**, or **GREVE**, the bailiff of a franchise, or manor, thus called, especially in the west of England. Hence shire-reve, sheriff port-greve, &c.
- REVEILLE**, a beat of drum about break of day, to give notice that it is time for the soldiers to arise, and that the sentries are to forbear challenging.
- REVEL**, a port-town of Livonia, situated at the south entrance of the gulph of Finland: E. long. 24°, N. lat. 59°.
- REVELATION**, the act of revealing, or making a thing public that was before unknown: it is also used for the discoveries made by God to his prophets, and by them to the world; and more particularly for the books of the Old and New Testament. See **BIBLE** and **RELIGION**.
- REVELATION of St John**. See **APOCALYPSE**.
- REVELS**, entertainments of dancing, masking, acting comedies, farces, &c. anciently very frequent in the inns of court, and in noblemens houses, but now much disused. The officer who has the direction of the revels at court, is called the master of the revels.
- REVENUE**, the annual income a person receives from the rent of his lands, houses, interest of money in the stocks, &c.
- REVENUE**, in hunting, a fleshy lump formed chiefly of a cluster of whitish worms on the head of deer, supposed to occasion their casting their horns by gnawing them at the roots.
- REVERBERATION**, in physics, the act of a body repelling or reflecting another after its impinging thereon.
- REVERBERATION**, in chemistry, denotes a kind of circulation of the flame by means of a reverberatory. See **CHEMISTRY**, p. 112.
- REVERBERATORY**, or **REVERBERATING FURNACE**. See **CHEMISTRY**, p. 112.
- REVEREND**, a title of respect given to ecclesiastics.
- REVERIE**, the same with delirium, raving, or distraction. It is used also for any ridiculous, extravagant imagination, action, or proposition, a chimera or vision. But the most ordinary use of the word, among English writers, is for a deep disorderly musing or meditation.
- REVERSE of a medal, coin, &c.** denotes the second or back side, in opposition to the head or principal figure.
- REVERSION** in Scots law. See **LAW**, Tit. xv. 1.
- REVIVIFICATION**, in chemistry. See **RESUSCITATION**.
- REVOLUTION**, in politics, signifies a grand change or turn in government; in which sense, the revolution is used, by way of eminence, for the great turn of affairs in England, in the year 1688, when king James II. abdicating the throne, the prince and princess of Orange were declared king and queen of England, &c. In geometry, the revolution of any figure, is its motion quite round a fixed line, as an axis.
- The revolution of a planet, or comet, round the sun, is nothing but its course from any point of its orbit till its return to the same. See **ASTRONOMY**.
- REVULSION**, in medicine, turning a flux of humours from one part to another, by bleeding, cupping, friction, sinapisms, blisters, fomentations, bathings, affusions, setons, &c. See **MEDICINE**.
- REYGATE**, or **RYGATE**, a borough of Surry, twenty-two miles south west of London. It sends two members to parliament.
- REZANSKOI**, the capital of the province of Rezan, in Russia: east long. 41°, north lat. 55°.
- RHAGADES**, in medicine, denotes chaps or clefts in any part of the body; arising either from any aridity of the parts, or acrimony of the humours.
- RHAMNUS**, in botany, a genus of the pentandria monogynia class. The calix is tubulose, the scales fortifying the stamina: it has no corolla: and the fruit is a berry. There are 20 species, none of them natives of Britain.
- RHAMPHASTOS**, in ornithology, a genus belonging to the order of picæ. The bill is large, convex; and serrated outwards each mandible is crooked inwards at the point; the nostrils are situate behind the base of the bill; the tongue resembles a feather; and the feet of most of them are fitted for climbing. There are eight species, principally distinguished by their colour.
- RHAPSODI**, *rhapsodists*, in antiquity, persons who made a business of singing pieces of Homer's poems. Cuper informs us, that the rhapsodi were clothed in red when they sung the Iliad, and in blue when they sung the Odyssey. They performed on the theatres, and sometimes strove for prizes in contests of poetry, singing, &c. But there seems to have been other rhapsodi of more antiquity than those people, who composed heroic poems or songs in praise of heroes and great men, and sung their own compositions from town to town for a livelihood, of which profession Homer himself is said to be.
- RHAPSODOMANCY**, an ancient kind of divination performed by pitching on a passage of a poet at hazard, and reckoning on it as a revelation of what was to come to pass.
- RHAPSODY**, in antiquity, a discourse in verse sung or rehearsed by a rhapsodist. Others will have rhapsody

- to signify a collection of verses, especially those of Homer, which having been a long time dispersed in pieces and fragments, were at length, by Pifistratus's order, digested into books called rhapsodies. Hence, among moderns, rhapsody is also used for an assemblage of passages, thoughts, and authorities, raked together from divers authors, to compose some new piece.
- RHE**, or **REE**, a little island in the bay of Biscay, near the coast of Annis in France: W. long.  $1^{\circ} 30'$ , N. lat.  $46^{\circ} 14'$ .
- RHEIMS**, or **REIMS**, a city of France, capital of the province of Champain, one of the most elegant cities in France, situated seventy-five miles north-east of Paris: E. long.  $4^{\circ}$ , N. lat.  $49^{\circ} 20'$ .
- RHETERIANS**, a sect of heretics in Egypt, so denominated from Rhetorius their leader. The distinguishing doctrine of this heresiarch, as represented by Philatrius, was, that he approved of all the heresies before him, and taught that they were all in the right.
- RHETORIC**, the art of speaking copiously on any subject, with all the advantage of beauty and force.
- Lord Bacon defines rhetoric, very philosophically, to be the art of applying and addressing the dictates of reason to the fancy, and of recommending them there so as to affect the will and desires. The end of rhetoric, the same author observes, is to fill the imagination with ideas and images which may assist nature without oppressing it. Vossius defines rhetoric, The faculty of discovering what every subject affords of use for persuasion. Hence, as every author must invent arguments to make his subject prevail; dispose those arguments, thus found out, in their proper places; and give them the embellishments of language proper to the subject; and, if this discourse be intended to be delivered in public, utter them with that decency and force which may strike the hearer; rhetoric becomes divided into four parts, invention, disposition, elocution, and pronunciation.
- Rhetoric and oratory differ from each other as the theory from the practice; the rhetorician being he who describes the rules of eloquence, and the orator he who uses them to advantage. Ordinarily, however, the two are used indifferently for each other. See **COMPOSITION**.
- RHEUM**, a thin serous humour, occasionally oozing out of the glands about the mouth and throat.
- RHEUM** in botany. See **BOTANY**, p. 642.
- RHEUMATISM**, in medicine. See **MEDICINE**, p. 124.
- RHEXIA**, in botany, a genus of the octandria monogynia class. The calix consists of four segments, and the corolla of four petals, inserted into the calix; and the antheræ are declined; and the capsule has four cells. There are three species, none of them natives of Britain.
- RHINANTHUS**, in botany, a genus of the didynamia angiospermia class. The calix is swelled, and has four segments; the capsule is obtuse, compressed, and bilocular. There are six species, only one of which, *viz.* the *crista-galli*, yellow rattle or cock's-comb, is a native of Britain.
- RHINE**, a great river rising in the country of the Grisons, in Switzerland, and, running north, continues its course till it forms the lake of Constance; from whence it turns west, and having visited Basil, runs north, dividing Suabia from Alsatia; from thence it runs through the Palatinate, and receiving the Neckar, the Maine, and the Moselle, continues its course north by Mentz, &c. After entering the Netherlands at Skenkinchans, it is divided into several channels, the two largest whereof obtain the names of the Lech and the Waal, which running through the United Provinces discharge themselves into the German sea below Rotterdam.
- RHINE lower circle** consists of the Palatinate of the Rhine and the three ecclesiastical electorates, *viz.* those of Cologne, Mentz, and Triers.
- RHINE upper circle** consisted of the Landgraves of Alsatia and Hesse, comprehending the Wetteraw: but only Hesse can be accounted a part of Germany at present, France having united Alsatia to that kingdom.
- RHINEBURG**, a town of Germany, in the circle of the lower Rhine and electorate of Cologne, situated fifteen miles east of Gelder.
- RHINEFIELD**, the name of two towns of Germany, one whereof is situated in the circle of Suabia, on the Rhine, eight miles east of Basil; the other is the capital of the county of Rhinefield, situated in the circle of the Upper Rhine, sixteen miles north-west of Mentz.
- RHINOCEROS**, in zoology, a genus of quadrupeds belonging to the order of bellæ, of which there is but one species, *viz.* the unicornis, a native of Africa and India. It has two fore-teeth in each jaw, situate at a great distance from each other, and blunt, and a solid conical horn upon the nose. This, of all quadrupeds, approaches nearest to the elephant in size, the body being nearly as bulky, but the legs much shorter. A full-grown rhinoceros is fourteen feet high; and the legs are so short with all this height, that the belly comes near the ground: the head is very large and oblong, of an irregular figure, broad at top, and depressed towards the snout: the ears resemble those of a hog: the eyes are very small, and situated at a small distance from the extremity of the snout: on the upper part of the snout, near the extremity, stands the horn, growing to about two feet and a half in length, bent a little back, of a black colour, and vastly firm and hard: the skin is remarkably thick and hard, so that the creature could not turn its body in any direction but for the joints and folds in it: the tail is short, and furnished with some long and extremely thick black hairs. The rhinoceros feeds upon thorns and brushwood; like the sow, he wallows in the mire. He is gentle and inoffensive, except when he is injured. But, when irritated, he even overturns large trees in his fury.
- RHINOCEROS BIRD**. See **BUCERGS**.
- RHIZOPHORO**, in botany, a genus of the dodecandria monogynia class. Both calix and corolla consist of four segments; and there is but one long seed, fleshy at the base. The species are seven, none of them natives of Britain.
- RHODES**, the capital of an island of that name, situated in the Mediterranean sea, in E. long.  $28^{\circ}$ , and between  $36^{\circ}$  and  $37^{\circ}$  N. lat.
- RHODIOLA**, in botany, a genus of the diœcia enneandria class. The calix of the male consists of four segments, and the corolla of four petals; the calix of the female has four segments; it has no corolla, but four nectaria, and four pistils; and it has four capsules, containing many seeds. There is but one species, *viz.* the rose, or rose-wort, a native of Britain.
- RHODODENDRUM**, in botany, a genus of the decar-

- dria monogynia class. The calix has five segments; the corolla is somewhat funnel-shaped; the stamina are declined; and the capsule has five cells. There are six species, none of them natives of Britain.
- RHOMBOIDES**, in geometry, a quadrilateral figure whose opposite sides and angles are equal, but is neither equilateral nor equiangular.
- RHOMBOIDES**, in anatomy. See **ANATOMY**, p. 193.
- RHOMBOIDIA**, in natural history, the name of a genus of spars, given them from their being of a rhomboidal form.
- RHOMBUS**, in geometry, an oblique-angled parallelogram, or a quadrilateral figure whose sides are equal and parallel, but the angles unequal, two of the opposite ones being obtuse, and the other two acute.
- RHOMBUS**, in ichthyology. See **PLEURONECTES**.
- RHONE**, one of the largest rivers in France; which rising in one of the Alps of Switzerland, passes through the lake of Geneva, visits that city, and then runs south-west to Lyons, where joining the river Soane, it continues its course due south, passing by Orange, Avignon, and Arles, and falls into the Mediterranean a little westward of Marseilles.
- RHUBARB**. See **BOTANY**, p. 642.
- RHUMB**, **RUMB**, or **RUM**, in navigation, a vertical circle of any given place, or the intersection of such a circle with the horizon; in which last sense, rumb is the same with a point of the compass. See **NAVIGATION**.
- RHUMB LINE**, is also used for the line which a ship describes when sailing in the same collateral point of the compass, or oblique to the meridians. See **NAVIGATION**.
- RHUS**, in botany, a genus of the pentandria trigynia class. The calix consists of five segments, and the corolla of five petals; and the berry contains but one seed. The species are 16, none of them natives of Britain.
- RHYME**, in poetry, the similar sound, or cadence and termination of two words which end two verses, &c. Or rhyme is a similitude of sound between the last syllable or syllables of a verse, succeeding either immediately, or at a distance of two or three lines.
- There is no rule in poetry, says Du Bos, whose observance costs so much trouble, and is productive of less beauties in verse, than that of rhyming. Rhyme frequently maims, and almost always enervates the sense of the discourse; for one bright thought which the passion of rhyming throws in our way by chance, is, without doubt, every day the cause of a hundred others that people would blush to make use of were it not for the richness or novelty of the rhyme with which these thoughts are attended.
- RHYTHM**, in musick, the variety in the movement, as to the quickness or slowness, length or shortness, of the notes. Or it may be defined more generally, the proportion which the parts of the motion have to each other. See **MUSICK**.
- RIBBAN**, or **RIBBON**, in heraldry, the eighth part of a bend, like that represented in Plate CXLVII. fig. 10.
- RIBBAND**, or **RIBBON**, a narrow sort of silk, chiefly used for head-ornaments, badges of chivalry, &c.
- RIBES**, in botany, a genus of the pentandria monogynia class. It has five stamina, and five petals, both inserted into the calix; the stylus is bifid, and the berry contains many seeds. There are eight species, three of them natives of Britain, viz. the rubrum, or currants; the alpinum, or sweet mountain currants; and the nigrum, or black currants.
- RIBS**, in anatomy. See **ANATOMY**, p. 173.
- RICCIA**, in botany, a genus of the cryptogamia algæ class. There are four species, all natives of Britain.
- RICE**, in botany. See **ORYZA**.
- RICHARDIA**, in botany, a genus of the hexandria monogynia class. The calix has six segments, and the corolla one subcylindrical petal; and the seeds are three. There is but one species, a native of Vera Cruz.
- RICHLIEU**, a town of France, in the province of Orleans and territory of Poitou, situated twenty-six miles north of Poitiers.
- RICHMOND**, a village in the county of Surry, ten miles west of London, formerly the residence of the kings of England.
- RICHMOND** is also a borough town of Yorkshire, thirty-three miles north-west of York. It sends two members to parliament.
- RICINUS**, in botany, a genus of the monœcia monadelphia class. The calix of the male has five segments; it has no corolla, but the stamina are numerous: The calix of the female has three segments; it has no corolla; the styli are three, and bifid; and the capsule has three cells, and one seed. There are three species, none of them natives of Britain.
- RICKETS**, in medicine. See **MEDICINE**, p. 169.
- RIDGE**, in agriculture, a long piece of rising land, between two furrows. See **AGRICULTURE**, p. 57.
- RIDGLING**, or **RIDGEL**, among farriers, &c. the male of any beast that has been but half geld.
- RIDICULE**, in matters of literature, is that species of writing, which excites contempt with laughter.
- RIDING**, a division of Yorkshire; of which there are three, viz. the east, west, and north ridings.
- In all indictments in that county, both the town and riding must be expressed.
- RIEF**, in Scots law. See **ROBBERY**.
- RIGA**, a port-town of Livonia, one of the best harbours and trading towns in the Baltic: E. long. 24°, N. lat. 57°.
- RIGGING of a ship**, is all her cordage and ropes, belonging to her masts, yards, &c.
- RIGHT**, in geometry, signifies the same with straight: thus, a straight line is called a right one.
- RIGIDITY**, in physics, denotes a brittle hardness. It is opposed to ductility, malleability, and softness.
- RIGOR**, in medicine, a convulsive shuddering, from severe cold, an ague-fit, or other disorder.
- RIMINI**, a port-town of Italy, in the territories of the pope, and province of Romania, situated on the gulph of Venice: E. long. 13° 30'. and N. lat. 44° 8'.
- RIND**, the skin of any fruit that may be cut off or pared. Rind is also used for the inner bark of trees, or that whitish soft substance which adheres immediately to the wood.
- RING**, an ornament of gold, silver, &c. made of a circular form, and generally worn on the finger.
- RING-BONE**, in farriery, a hard callous substance, growing in the pasterm of a horse, above the coronet: it is thus called from its growing quite round like a ring. See **FARRIERY**.

**RIO GRANDE**, a river of Terra Firma, which rising almost under the equator, and running north, falls into the north sea between Carthage and St Martha.

**RIO GRANDE** is also a river of Africa, which runs from east to west through Negroland, and falls into the Atlantic ocean, in 11° N. lat.

**RIO JANEIRO**, a river of South America, which rises in the mountains west of Brazil, and falls into the Atlantic ocean almost under the tropic of capricorn.

**RIOT**, in law, is where three or more persons, assembled together, commit some unlawful act, with force and violence, to the disturbance of the peace; as beating some person, forcibly entering upon the possession of the lands, houses, &c. of another, or breaking down inclosures, houses, &c.

By stat. 1. Geo. I. cap. v. if any persons to the number of twelve or more, unlawfully and riotously assembled, continue together for an hour, after being required, by a justice of the peace, or other magistrate, to disperse, they shall be deemed guilty of felony without benefit of clergy. However, prosecutions upon this statute, must be begun within one year after the offence is committed.

**RIPPON**, a borough-town of Yorkshire, twenty one miles north-west of York. It sends two members to parliament.

**RISK**, in gaming, &c. See **CHANCE**.

**RITE**, among divines, denotes the particular manner of celebrating divine service, in this or that country.

**RITORNELLO**, or **REPEAT**, in music, the burden of a song, or the repetition of the first or other verses of a song at the end of each stanza or couplet.

**RITUAL**, a book directing the order and manner to be observed in celebrating religious ceremonies, and performing divine service in a particular church, diocese, order, or the like.

**RIVAL**, a term applied to two or more persons, who have the same pretensions, and which is properly applied to a competitor in love, and figuratively to an antagonist in any other pursuit.

**RIVER** a current or stream of fresh water flowing in a bed or channel from its source into the sea.

The great as well as the middle-sized rivers proceed either from a confluence of brooks and rivulets, or from lakes; but no river of considerable magnitude flows from one spring, or one lake, but is augmented by the accession of others. Thus the Wolga receives above two hundred rivers and brooks before it discharges itself into the Caspian Sea; and the Danube receives no less, before it enters the Euxine Sea.

**RIVINIA**, or **RIVINA**, in botany, a genus of the tetrandria monogynia class. The corolla consists of four permanent petals; it has no calix; and the berry contains one rough seed. There are two species, none of them natives of Britain.

**RIVULET**, a diminutive of river. See **RIVER**.

**ROACH**, in ichthyology. See **CYPRINUS**.

**ROANOAK**, an island in North America, near the coast of Albermarle-county, in North Carolina: W. long. 75°, N. lat. 35° 40'.

**ROB**, in pharmacy, the juices of fruits purified and inspissated till it is of the consistence of honey.

Rob of alder-berries is thus prepared: Take two quarts of the juice of ripe alder-berries, and half a pound of re-

fined sugar. Evaporate over a gentle fire, or in a water bath, till it is of a due consistence.

**ROBBERY**, in law, a felonious taking away another's goods, from his person, presence, or estate, by putting him in fear. See **LAW**, Tit. xxxiii. 30.

**ROBINIA**, in botany, a genus of the diadelphia decandria class. The vexillum is open, reflected, and roundish; the calix has four teeth, the uppermost being emarginated. There are six species, none of them natives of Britain.

**ROBORANTS**, in pharmacy, medicines which strengthen the parts, and give new vigour to the constitution.

**ROCHEFOUCAUT**, a town of Orleans, in France, fifteen miles east of Angoulême.

**ROCHELLE**, a city and port-town of Orleans, in France: W. long. 1° 5', N. lat. 46° 7'.

**ROCHESTER**, a city of Kent, situated on the river Medway, thirty miles east of London, and twenty-two west of Canterbury.

**ROCHFORD**, a market-town of Essex, thirty-three miles east of London, and fifteen south-east of Chelmsford.

**ROCHFORT**, a port-town of Guienne, in France, twenty-three miles south of Rochelle: W. long. 1°, N. lat. 46°.

It is one of the stations of the French navy, having a commodious harbour, well secured by forts and batteries.

**ROCK**, a large mass or block of hard stone rooted in the ground.

**Rock-crystal**, otherwise called sprig-crystal, in natural history, a name given to the third order of crystals, from their being affixed to a rock or other solid body.

This kind of crystal is the most common of all others, and is what the generality of authors describe under the name of crystal of the shops, being that kept for medicinal purposes.

The clearest, purest, and most transparent that can be had, ought to be chosen; and to prove its genuineness, it may be tried with aqua fortis, true crystal making no effervescence with that menstruum.

**ROCKET**, an artificial fire-work, consisting of a cylindrical case of paper, filled with a composition of certain combustible ingredients; which, being tied to a stick, mounts into the air, to a considerable height, and there bursts.

**ROCKINGHAM**, a market-town of Northamptonshire, situated nineteen miles north of Northampton.

**ROD**, a land measure of sixteen feet and a half: the same with perch and pole.

**Black Rod**, a staff carried by the king's gentleman-usher, as a badge of his office; this rod or staff is black, and has a lion in gold on its top. See **USHER**.

**Fishing Rod**, a long taper rod or wand, to which the line is fastened for angling.

**ROE**, the spawn or seed of fish. That of the male fishes is usually distinguished by the name of soft roe, or milt; and that of the female, by hard roe, or spawn.

So inconceivably numerous are these ova, or small eggs, that M. Petit found 342144 of them in a carp of eighteen inches: but M. Leewenhoeck found in a carp no more than 211629. This last gentleman observes, that there are four times this number in a cod, and that a common one contains 9344000 eggs.

**ROE**, in zoology. See **CERVUS**.

**ROELLA**,

**ROELLA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel-shaped; the stigma is bifid; and the capsule is cylindrical, and has two cells.

The species are two, none of them natives of Britain.  
**ROER**, the name of two rivers in Germany, one of which rises on the confines of Hesse, and falls into the Rhine, a little below Duisburg; the other rises in the duchy of Juliers, and falls into the Maese at Roermond.

**ROGA**, in antiquity, a present which the emperors made to the senators, magistrates and even to the people; and the popes or patriarchs to their clergy.

These rogæ were distributed by the emperors on the first day of the year, on their birth day, or on the natalis dies of the cities; and by the popes and patriarchs, in passion-week.

Roga is also used for the common pay of the soldiers.  
**ROGATION**, in the Roman jurisprudence, a demand made by the consuls or tribunes of the Roman people, when a law was proposed to be passed. Rogatio is also used for the decree itself made in consequence of the peoples giving their assent to this demand, to distinguish it from a senatus-consultum, or decree of the senate.

**ROGATION WEEK**, the week immediately preceding Whit-sunday, so called from the three fasts therein, on Monday, Tuesday, and Wednesday, which are also called rogations, or rogation days, from the extraordinary prayers and supplications at this time offered to God by devout Christians to appease his anger and deprecate his judgments.

**ROGUE**, in law, an idle sturdy beggar; who by ancient statutes is for the first offence called a rogue of the first degree; and punished by whipping, and boring through the gristle of the right ear with a hot iron; and for the second offence, is termed a rogue of the second degree, and, if above eighteen-years of age, ordered to be executed as a felon.

**ROHAN**, a town of France, in the province of Brittany, situated twenty miles north of Vannes.

**ROLL**, in manufactories, something wound and folded up in a cylindrical form.

**ROLL**, in law, signifies a schedule or parchment which may be rolled up by the hand into the form of a pipe.

*Mustel-Roll*, that in which are entered the soldiers of every troop, company, regiment, &c.

**ROLLS-OFFICE**, is an office in Chancery-lane, London, appointed for the custody of the rolls and records in chancery.

**ROLLS of parliament**, are the manuscript registers, or rolls of the proceedings of our ancient parliaments, which, before the invention of printing, were all engrossed on parchment, and proclaimed openly in every county. In these rolls are also contained a great many decisions of difficult points of law, which were frequently in former times referred to the decision of that high court.

**ROLL**, or **ROLLER**, is also a piece of wood, iron, brass, &c. of a cylindrical form, used in the construction of several machines, and in several works and manufactures.

**ROMAN**, in general, something belonging to the city of Rome. See **ROME**.

*King of the Romans*, in modern history, is a prince elected to be successor to the reigning emperor of Germany.

**ROMANCE**, in matters of literature, a fabulous relation of certain adventures designed for the entertainment and instruction of the readers.

The true nature and genuine characteristics of this species of writing are excellently explained by the ingenious author of the *Rambler*; who observes, that the works of fiction, with which the present generation seems more particularly delighted, are such as exhibit life in its true state, diversified only by the accidents that daily happen in the world, and influenced by those passions and qualities which are really to be found in conversing with mankind.

**ROMANIA**, a province of the pope's territories in Italy, including the Bolognese and Ferrarese. See **BOLOGNA** and **FERRARA**.

**ROMANIA**, is also the modern name of ancient Thrace, which now makes a province of Turkey in Europe; lying westward of the Propontis, between the Euxine sea and the Archipelago.

**ROME**, the capital of the pope's territories and of Italy, and anciently the mistress of the Roman Empire: E. lon. 13°, N. lat. 41° 45'.

Rome is still a large and fine city, though not to be compared to ancient Rome; the streets are spacious, and magnificently built; it has five bridges over the Tiber, twenty gates, three hundred churches, and a vast number of palaces, convents, triumphal arches, pillars, obelisks, statues, theatres, &c.

**ROMNEY**, a borough town of Kent, and one of the cinque ports, situated twelve miles south-west of Dover. It sends two members to parliament.

**ROMPEE**, or **ROMPU**, in heraldry, is applied to ordinaries that are represented as broken, and to chevrons, bends, or the like, whose upper points are cut off. See Plate CXLVII. fig. 11.

**RONDELETIA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel shaped; and the capsule has two cells, containing many round coronated seeds. There are two species, none of them natives of Britain.

**ROOD**, a quantity of land equal to forty square perches, or the fourth part of an acre.

**ROOF**, in architecture, the uppermost part of a building. See **ARCHITECTURE**, p. 361.

**ROOK**, in ornithology. See **CORVUS**.

**ROOM**, a chamber, parlour, or other apartment, in a house. See **ARCHITECTURE**, p. 359.

**ROOT**, among botanists, denotes that part of a plant which imbibes the nutritious juices of the earth, and transmits them to the other parts. See **AGRICULTURE**, p. 42.

**ROOT**, in algebra and arithmetick. See **ALGEBRA**, p. 84. &c. and **ARITHMETICK**, p. 420.

**ROPE**, hemp, hair, &c. spun out into a thick yarn, and then several strings of this yarn twisted together by means of a wheel. When made very small, it is called a cord; and when very thick, a cable.

**ROPE YARN**, among sailors, is the yarn of any rope untwisted, but commonly made up of junk; its use is to make sinnet, mats, &c.

**ROSA**, in botany, a genus of the icosaandria polygamia class. The petals are five; the calix has five fleshy segments; and the seeds are numerous, rough, and inserted into the interior side of the calix. There are 14 species, five of them natives of Britain, viz. the eglanteria, or sweet briar; the spinosissima, or burnet rose; the arvensis, or white-flowered dogs-rose; the villosa, or apple-rose; and the canina, or a red-flowered dogs-rose, or hip-tree.

**ROSA-**

**ROSACEOUS**, among botanists, an appellation given to such flowers as are composed of several petals or leaves, disposed in a sort of circular form, like those of the rose.

**ROSARY**, among the Roman-catholics. See **CHAPLET**.

**ROSCOMMON**, a county of Ireland, bounded by Leitrim on the north, and Galway on the south.

**ROSE**, in botany. See **ROSA**.

**ROSE NOBLE**, an ancient English gold-coin, first struck in the reign of Edward III. It was formerly current at 6s 8d. and so called because stamped with a rose.

**ROSMARINUS**, in botany, a genus of the diandria monogynia class. The corolla is unequal, and the upper lip of it is split into two segments; the filaments are long, crooked, and simple. There is but one species, *viz.* the *officinalis*, a native of Spain.

Rosemary is a very valuable cephalic, and is good in all disorders of the nerves, and in hysterical and hypochondriac diseases. It is good in palsies, apoplexies, epilepsies, and vertiges.

**ROSIENNE**, a town of Samogitia, in Poland: E. long. 23° 30', N. lat. 55° 50'.

**ROSIN**. See **RESIN**.

**ROSS**, a county of Scotland, bounded by Sutherland on the north, by the German sea and the Murray frith on the east and south, and by Inverness-shire and the western ocean on the south and west.

Ross is also a market-town, situated on the river Wye, eleven miles south of Hereford,

**ROSSE**, a port-town of Ireland, twenty-two miles west of Kinsale.

**ROS-SOLIS**, **SUN-DEW**, an agreeable spirituous liquor, composed of burnt brandy, sugar, cinnamon, and milk-water; and sometimes perfumed with a little musk: it is so called, as being at first prepared wholly of the juice of the plant *ros-folis*, or *drosera*. See **DROSER**.

**ROSTOCK**, an imperial city of Lower Saxony, situated on a bay of the Baltic sea: E. long. 12° 15', and N. lat. 54° 20'.

**ROSTOF**, or **ROSTOVA**, the capital of a territory of the same name, in Russia: E. lon. 40°, and N. lat. 57° 20'.

**ROSTRA**, in antiquity, a part of the Roman forum, wherein orations, pleadings, funeral harangues, &c. were delivered.

**ROSTRUM**, literally denotes the beak or bill of a bird; and hence it has been figuratively applied to the beak, or head of a ship.

**ROSYCRUCIANS**, **ROSIERUCIANS**; or *brothers of the rosy cross*. a name assumed by a sect or cabal of hermetical philosophers, who appeared, or at least were first taken notice of, in Germany, in the beginning of the XVIIth century. They pretended to be masters of all sciences, and to have many important secrets, particularly that of the philosophers stone.

Their society is frequently denoted by the abbreviatures **F.R.C.**

**ROT**, a disease incident to sheep, arising from wet seasons, and too moist pasture. It is a very hard thing to prevent the rot, if the year prove very wet, especially in May and June. Salt-marshes, and lands where broom grows, are the best places of preservation for them. Sheep are sometimes all cleared of the rot, when not too far gone

with it, only by removing them into broom-fields. Scurvy-grass, mustard, parsley, and thyme, are also good for the prevention of it.

**ROTA**, the name of an ecclesiastical court at Rome, composed of twelve prelates, whereof one must be a German, another a Frenchman, and two Spaniards; the other eight are Italians, three of whom must be Romans, and the other five a Bolognese, a Ferraran, a Milanese, a Venetian, and a Tuscan.

This is one of the most august tribunals in Rome, which takes cognizance of all suits in the territory of the church, by appeal; as also of all matters beneficiary and patrimonial.

**ROTATION**, in geometry, a term chiefly applied to the circumvolution of any surface round a fixed and immovable line, which is called the axis of its rotation: and by such rotations it is, that solids are conceived to be generated

**ROTHERAM**, a market-town of Yorkshire, 35 miles south-west of York.

**ROTHSAY**, a parliament-town of Scotland, in the isle of Bute: W. long. 5°, and N. lat. 55° 50'.

**ROTONDO**, or **ROTONDO**, in architecture, an appellation given to any building that is round both within and without side, whether it be a church, a salon, or the like. The most celebrated rotondo of the ancients, is the pantheon at Rome.

**ROTTEENESS**. See **PUTREFACTION**.

**ROTTERDAM**, a city of the province of Holland, situated on the north bank of the Maese, thirty miles south of Amsterdam, and thirteen miles south-east of the Hague: E. long. 4° 20', and N. lat. 52°.

**ROTULA**, in anatomy, See **ANATOMY**, p. 185.

**ROTUNDUS**, in anatomy, a name given to several muscles, otherwise called *teres*.

**ROUEN**, a city of France, and capital of Normandy, situated on the north side of the Seyne, sixty-five miles north of Paris, and forty-five miles south-east of Havre de Grace and the British channel: E. long. 1° 6', N. lat. 49° 30'.

**ROVIGO**, the capital of the Polem de Rovigo, in Italy, subject to Venice: E. long. 12° 25', N. lat. 45° 6'.

**ROUND-HOUSE**, a kind of prison, for the nightly watch in London to secure disorderly persons, till they can be carried before a magistrate.

**ROUND-HOUSE**, in a ship, the uppermost room, or cabin, on the stern of a ship, where the master lies.

**ROUNDELAY**, a kind of ancient poem thus termed, according to Menage, from its form, because it turns back again to the first verse, and thus goes round. This poem is little known among us, but is very common among the French, who call it *rondeau*. It consists commonly of thirteen verses, eight whereof are in one rhyme, and five in another. It is divided into couplets, at the end of the second and third whereof the beginning of the roundelay is repeated, and that if possible in an equivocal or pausing sense.

**ROUSILLON**, formerly a province of Spain, now united to France, is bounded by Languedoc on the north, by the Mediterranean sea on the east, by Catalonia on the south, and by the Pyrenean mountains on the west, being about fifty-five miles long, and thirty-six broad.

**ROUTE**,

**ROUTE**, a public road, highway, or course, especially that which military forces take. This word is also used for the defeat and flight of an army.

**ROUT**, in law, is applied to an assembly of persons, going forcibly to commit some unlawful act, whether they execute it or not.

**ROWEL**, among farriers, a kind of issue, made by drawing a skin of silk, thread, hair, or the like, through the nape of the neck, or other part of a horse; answering to what in surgery is called a seton. See **FARRIERY**.

**ROXBURGH**, the name of a county in Scotland, which sends one member to parliament.

**ROXENT CAPE**, or *Rock of Lisbon*, a mountain and remarkable promontory in Portugal, situated in the Atlantic ocean, at the north entrance of the river Tagus, twenty-two miles north of Lisbon.

**ROYAL**, something belonging to a king; thus we say, royal family, royal assent, royal exchange, &c.

**ROYAL-oak**, a fair spreading tree at Boscobel, in the parish of Donnington in Staffordshire, the boughs whereof were once covered with ivy; in the thick of which king Charles II. sat in the day time with colonel Careless, and in the night lodged in Boscobel house: so that they are mistaken who speak of it as an old hollow oak, it being then a gay flourishing tree, surrounded with many more. The poor remains thereof are now fenced in with a handsome wall, with this inscription over the gate in gold-letters: *Felicissimam arborem quam in asylum potentissimi regis Caroli II. Deus op. max. per quem reges regnant, hic crescere voluit, &c.*

**ROYAL-society**. See **SOCIETY**.

**ROYALTIES**, the rights of the king, otherwise called the king's prerogative, and the regalia. See **PREROGATIVE**, and **REGALIA**.

**ROYENA**, in botany, a genus of the decandria digynia class. The calix is urceolated; the corolla consists of one petal, bent back at the edge; the capsule has one cell, and four valves. There are three species, all natives of the Cape of Good Hope.

**ROYSTON**, a market-town, situated in the counties of Hertford and Cambridge, thirty-eight miles north of London.

**RUBELLIO**, in ichthyology. See **CYPRINUS**.

**RUBETA**, in zoology. See **RANA**.

**RUBIA**, in botany, a genus of the tetrandria monogynia class. The corolla consists of one bell-shaped petal; and the berry contains one seed. There are two species, none of them natives of Britain.

**RUBIGALIA**, in antiquity, a feast celebrated by the Romans, in honour of the god Rubigus, or the goddess Rubigo, to engage these deities to preserve the corn from blights and mildews.

**RUBIGO**, a disease incident to corn, commonly called Mildew, being a species of blight. See **BLIGHT**.

**RUBININSKA**, one of the northern provinces of Russia, bounded by the province of Dwina on the north, by Syrianes on the east, by Belozero on the south, and by the lake of Onega on the west.

**RUBRIC**, in the canon-law, signifies a title or article in certain ancient law-books; thus called because written, as the titles of the chapters in our ancient Bibles are, in red letters.

**RUBUS**, in botany, a genus of the icofandria polygynia

class. The calix consists of five segments, and the corolla of five petals; and the berry has many seeds. There are 13 species, five of them natives of Britain, *viz.* the idæus, or raspberry-bush, the cæsius, or small bramble; the fruticosus, or common bramble; the saxatilis, or stone-bramble; and the chamæmorus, or cloud-berries.

**RUBY**, in natural history, a species of gems, being a beautiful gem of a red colour with an admixture of purple.

This, in its most perfect and best coloured state, is a gem of prodigious beauty and extreme value; it is often found perfectly pure and free from blemishes or foulness, but much more frequently debased generally in its value by them, especially in the larger specimens. It is of very great hardness, equal to that of the sapphire, and second only to the diamond. It is various in size, but less subject to variations in its shape than most of the other gems. It is usually found very small, its most common size being equal to that of the head of the largest sort of pins; but it is found of four, eight, or ten carats, and sometimes, though very rare, up to twenty, thirty, or forty. It is never found of an angular or crystalliform shape, but always of a pebble-like figure, often roundish, sometimes oblong and much larger at one end than at the other, and in some form resembling a pear, and is usually flattened on one side. It commonly is naturally so bright and pure on the surface, as to need no polishing; and when its figure will admit of being set without cutting, it is often worn in its rough state, and with no other than its native polish.

We have the true ruby only from the East Indies; and the principal mines of it are in the kingdom of Pegu and the island of Ceylon.

**RUBY**, in heraldry, denotes the red colour wherewith the arms of noblemen are blazoned; being the same which, in the arms of those not noble, is called, gules. See **GULES**.

**RUCTATION**, a ventosity arising from indigestion, and discharging itself at the mouth with a very disagreeable noise.

**RUDBECKIA**, in botany, a genus of the syngenesia polygamia frustranea class. The receptacle is conical and paleaceous: the pappus has four teeth on its edge; and the calix consists of a double row of scales. There are six species, none of them natives of Britain.

**RUDDER**, in navigation, a piece of timber turning on hinges in the stern of the ship, and which, opposing sometimes one side in the water and sometimes another, turns or directs the vessel this way or that. See **SHIP**.

**RUDENTURE**, in architecture, the figure of a rope or staff, sometimes plain, sometimes carved, with which the third part of flutings of columns are frequently filled up.

**RUDIARUS**, in antiquity, a veteran gladiator who had got a discharge from the service.

**RUDIMENTS**, the first principles or grounds of any art or science, called also the elements thereof.

**RUE**, in botany. See **RUTA**.

**RUELLA**, in botany, a genus of the didynamia angiospermia class. The calix has five segments, and the corolla is subcampanulated; and the stamina are very near each other. There are eleven species, none of them natives of Britain.

**RUFF**, in ichthyology. See **PERCA**.

**RUFF**, in ichthyology. See **TRINGA**.

**RUGEN**,

**RUGEN**, an island of the Baltic sea, on the coast of Germany, being part of the duchy of Swedish Pomerania, separated from the continent by a narrow channel: this island is thirty miles long, and near as many broad.

**RUINS**, a term particularly used for magnificent buildings fallen into decay by length of time, and whereof there only remains a confused heap of materials.

**RULE**, in matters of literature, a maxim, canon, or precept, to be observed in any art or science.

**RULE OF THREE**. See **ARITHMETICK**, p. 331.

**RULE**, or **RULER**, an instrument of wood or metal, with several lines delineated on it, of great use in practical mensuration. When a ruler has the lines of chords, tangents, sines, &c. it is called a plane scale.

**RUM**, a species of brandy or vinous spirits, distilled from sugar-canes.

Rum, according to Dr. Shaw, differs from simple sugar-spirit, in that it contains more of the natural flavour or essential oil of the sugar-cane; a great deal of raw juice and parts of the cane itself being often fermented in the liquor or solution of which the rum is prepared. The unctuous or oily flavour of rum is often supposed to proceed from the large quantity of fat used in boiling the sugar; which fat, indeed, if coarse, will usually give a stinking flavour to the spirit, in our distillations of the sugar liquor, or wash, from our refining sugar-houses; but this is nothing of kin to the flavour of the rum, which is really the effect of the natural flavour of the cane.

The method of making rum is this: When a sufficient stock of the materials is got together, they add water to them, and ferment them in the common method, though the fermentation is always carried on very slowly at first; because at the beginning of the season for making rum in the islands, they want yeast, or some other ferment to make it work; but by degrees, after this, they procure a sufficient quantity of the ferment, which rises up as a head to the liquor in the operation; and thus they are able afterwards to ferment and make their rum with a great deal of expedition, and in large quantities.

When the wash is fully fermented, or to a due degree of acidity, the distillation is carried on in the common way, and the spirit is made up proof: though sometimes it is reduced to a much greater strength, nearly approaching to that of alcohol or spirit of wine, and it is then called double-distilled rum. It might be easy to rectify the spirit, and bring it to much greater purity than we usually find it to be of: for it brings over in the distillation a very large quantity of the oil; and this is often so disagreeable, that the rum must be suffered to be by a long time to mellow before it can be used; whereas, if well rectified, it would grow mellow much sooner, and would have a much less potent flavour.

The best state to keep rum in, both for exportation and other uses, is doubtless that of alcohol, or rectified spirit. In this manner it would be transported in one half the bulk it usually is, and might be let down to the common proof-strength with water when necessary; for the common use of making punch, it would likewise serve much better in the state of alcohol; as the taste would be cleaner; and the strength might always be regulated to a much greater exactness than in the ordinary way.

The only use to which it would not so well serve in this state, would be the common practice of adulteration

among our distillers; for when they want to mix a large portion of cheaper spirit with the rum, their business is to have it of the proof-strength, and as full of the flavouring oil as they can, that it may drown the flavour of the spirits they mix with it, and extend its own. If the business of rectifying rum was more nicely managed, it seems a very practicable scheme to throw out so much of the oil, as to have it in the fine light state of a clear spirit, but lightly impregnated with it; in this case it would very nearly resemble arrac, as is proved by the mixing a very small quantity of it with a tasteless spirit, in which case the whole bears a very near resemblance to arrac in flavour.

Rum is usually very much adulterated in England; some are so bare-faced as to do it with malt-spirit; but when it is done with molasses-spirit, the tastes of both are so nearly allied, that it is not easily discovered. The best method of judging of it is, by setting fire to a little of it; and when it has burnt away all the inflammable part, examining the phlegm both by the taste and smell.

**RUMELIA**, in geography, the same with ancient Greece, now a part of Turkey in Europe.

**RUMEN**, the paunch, or first stomach of such animals as chew the cud, thence called ruminant animals.

The rumen is by far the largest of all the stomachs, and in it the whole mass of crude aliments, both solid and liquid, lies and macerates, to be thence transmitted to the mouth to be again chewed, comminuted, and fitted for farther digestion in the other ventricles.

**RUMEX**, in botany, a genus of the hexandria trigynia class. The calix has three leaves, and the corolla three connivent petals; and there is but one triangular seed. The species are 27, of which ten are natives of Britain.

**RUMFORD**, a market-town of Essex, ten miles east of London.

**RUNGS**, in a ship, the same with the floor or ground timbers, being the timbers which constitute her floor, and are bolted to the keel, whose ends are rung-heads.

**RUNG-heads**, in a ship, are made a little bending, to direct the sweep or mold of the futtocks and navel timbers: for here the lines, which make the compass and bearing of a ship, do begin.

**RUNIC**, a term applied to the language and letters of the ancient Goths, Danes, and other northern nations.

**RUNNER**, in the sea-language, a rope belonging to the garnet, and to the two bolt-tackles. It is reeved in a single block, joined to the end of a pennant, and has at one end a hook to hitch into any thing, and at the other end a double block, into which is reeved the fall of the tackle, or the garnet, by which means it purchases more than the tackle would without it.

**RUNNET**, or **RENNET**, the acid juice found in the stomachs of calves that have fed on nothing but milk, and are killed before the digestion is perfect. It curdles milk.

**RUPERT'S DROPS**, a sort of glass-drops with long and slender tails, which burst to pieces on the breaking off those tails in any part. said to have been invented by prince Rupert, and therefore called after his name. This surprising phenomenon is supposed to arise from hence, that while the glass is in fusion, or in a melted state, the particles of it are in a state of repulsion; but being dropped into cold water, it so condenses the particles in the external parts of their superficies, that they are easily reduced



The Sabæans began with worshipping the heavenly bodies, which they fancied were animated by inferior deities. In the consecration of their images, they used many incantations to draw down into them from the stars those intelligences for whom they erected them, whose power and influence they held afterwards dwelt in them. This religion, it is said, first began among the Chaldæans, with their knowledge in astronomy: and from this it was, that Abraham separated himself, when he came out of Chaldæa. From the Chaldæans it spread all over the east; and from thence to the Grecians, who propagated it to all the nations of the known world. The remainder of this sect still subsists in the east, and pretend to derive their name from Sabius a son of Seth; and among the books in which the doctrines of this sect are contained, they have one which they call the book of Seth, and which they pretend was written by that patriarch.

**SABBATH**, or the day of rest, a solemn festival of the Jews, on the seventh day of the week, or Saturday, beginning from sun-set on Friday, to sun-set on Saturday.

The observation of the Sabbath began with the world: for God having employed six days in its creation, appointed the seventh as a day of rest to be observed by man, in commemoration of that great event. On this day the Jews were commanded to abstain from all labour, and to give rest to their cattle. They were not allowed to go out of the city farther than two thousand cubits, or a mile; a custom which was founded on the distance of the ark from the tents of the Israelites, in the wilderness, after their leaving Egypt; for being permitted to go, even on the sabbath-day, to the tabernacle to pray, they from thence inferred, that the taking a journey of no greater length, tho' on a different account, could not be a breach of the sabbatical rest.

As the seventh day was a day of rest to the people, so was the seventh year to the land; it being unlawful in this year to plow or sow, and whatever the earth produced belonged to the poor: this was called the sabbatical year. The Jews, therefore, were obliged, during the six years, and more especially the last, to lay up a sufficient store for the sabbatical year.

The modern, as well as the ancient, Jews, are very superstitious in the observance of the sabbath; they carry neither arms, nor gold nor silver about them, and are permitted neither to touch these, nor a candle, nor any thing belonging to the fire; on which account they light up lamps on Friday, which burn till the end of the sabbath.

**SABELLIANS**, a sect of Christians of the III<sup>d</sup> century, that embraced the opinions of Sabellius, a philosopher of Egypt, who openly taught that there is but one person in the Godhead.

The Sabellians maintained, that the Word and the Holy Spirit are only virtues, emanations, or functions of the Deity: and held, that he who is in heaven is the Father of all things, descended into the virgin, became a child, and was born of her as a son; and that having accomplished the mystery of our salvation, he diffused himself on the apostles in tongues of fire, and was then denominated the Holy Ghost. This they explained by resembling God to the sun, the illuminative virtue or quality of which was the Word, and its warming virtue

the Holy Spirit. The Word, they taught, was darted, like a divine ray, to accomplish the work of redemption; and that, being re-ascended to heaven, the influences of the Father were communicated after a like manner to the apostles.

**SABINA**, in botany. See **JUNIPERUS**.

**SABINA**, a province of Italy, in the pope's territories, bounded by Umbria on the north, by Naples on the east, by the Campania of Rome on the south, and by St Peter's Patrimony on the west.

**SABLE**, in zoology. See **MUSTELA**.

**SABLE**, in heraldry, denotes the colour black, in coats of arms belonging to gentlemen; but in those of noblemen it is called diamond; and in those of sovereign princes, Saturn. See **COLOUR**.

It is expressed in engraving by perpendicular and horizontal hatches crossing one another, as represented in Plate CXLVII. fig. 13.

**SABLUSTAN**, a province of Persia, which comprehending Gaur and Candahor, is bounded by Chorassan on the north, by India on the east, and by Sigistan on the south.

**RABRE**, a kind of sword or scimiter, with a very broad and heavy blade, thick at the back, and a little falcated or crooked towards the point: it is the ordinary weapon worn by the Turks, who are said to be very expert in the use of it.

**SABURRÆ**, **GRITTS**, in natural history, a genus of fossils, found in minute masses, forming together a kind of powder, the several particles of which are of no determinate shape, nor have any tendency to the figure of crystal, but seem rudely broken fragments of larger masses; not to be dissolved or diluted by water, but retaining their figure in it, and not cohering by means of it into a mass; considerably opaque, and in many species fermenting with acids: often souled with heterogeneous matters, and not unfrequently taken in the coarser stony and mineral or metalline particles.

Gritts are of various colours, as, 1. The stony and sparry gritts, of a bright or greyish white colour. 2. The red stony gritts. 3. The green stony gritts, composed of homogeneous sparry particles. 4. The yellow gritt, of which there is only one species. 5. The black and blackish gritts, composed of stony or talcaceous particles.

**SACCADE**, in the manege, is a jerk more or less violent, given by the horseman to the horse, in pulling or twitching the reins of the bridle all on a sudden, and with one pull, and that when a horse lies heavy upon the hand, or obstinately arms himself.

**SACCAI**, a city and port-town of Japan, situated on the bay of Mecao, three hundred miles south-west of Jeddo: E. long. 135°, and N. lat. 36.

**SACCHARUM**, in botany, a genus of the triandria digynia class. It has no calix, but long down in place of it; and the corolla has two valves. There are two species, both natives of India. See **SUGAR**.

**SACCHARUM SATURNI**, *sugar of lead*, is thus ordered to be made in the London Dispensatory; boil ceruse with distilled vinegar, until the vinegar becomes sufficiently sweet; then filter the vinegar through paper, and after due evaporation set it to crystallize.

**SACCULUS**, in anatomy, a diminutive of *saccus*, signifies a little bag, and is applied to many parts of the body. See **ANATOMY**.

SACER, in ornithology. See FALCO.

SACERDOTAL, something belonging to priests. See PRIEST.

SACK of wool, a quantity of wool containing just twenty-two stone, and every stone fourteen pounds. In Scotland, a sack is twenty four stone, each stone containing sixteen pounds.

SACK of cotton wool, a quantity from one hundred and a half to four hundred weight.

SACKS of earth, in fortification, are canvas bags filled with earth. They are used in making retrenchments in haste, to place on parapets, or the head of the breeches, &c. to repair them, when beaten down.

SACKBUT, a musical instrument of the wind kind, being a sort of trumpet, though different from the common trumpet both in form and size: it is fit to play a bass, and is contrived to be drawn out or shortened, according to the tone required, whether grave or acute. The Italians call it trombone, and the Latins tuba dactylis.

SACRAMENT, signifies, in general, a sign of a thing sacred and holy; and is defined to be an outward and visible sign of a spiritual grace. Thus there are two objects in a sacrament, the one the object of the senses, and the other the object of faith. Protestants admit only of two sacraments, baptism and the eucharist or Lord's supper; but the Roman-catholics own seven, viz. baptism, confirmation, the eucharist, penance, extreme unction, ordination, and marriage.

The Romanists, however, by way of eminence, call the eucharist the holy sacrament. Thus to expose the holy sacrament, is to lay the consecrated host on the altar to be adored. The procession of the holy sacrament, is that in which this host is carried about the church, or about a town.

SACRAMENTARY, an ancient Romish church-book, which contains all the prayers and ceremonies practised at the celebration of the sacraments.

It was wrote by pope Gelasius, and afterwards revised, corrected, and abridged by St Gregory.

SACRED, something holy, or that is solemnly offered and consecrated to God, with benedictions, unctions, &c.

SACRIFICE, a solemn act of religious worship, which consisted in dedicating or offering up something animate or inanimate on an altar, by the hands of the priest, either as an expression of their gratitude to the Deity for some signal-mercy, or to acknowledge their dependance on him, or to conciliate his favour. The origin of sacrifices is by some ascribed to the Phœnicians; but Porphyry ascribes it to the Egyptians, who first offered the first-fruits of their grounds to the gods, burning them upon an altar of turf: thus in the most ancient sacrifices there were neither living creatures, nor any thing costly or magnificent, and no myrrh or frankincense. At length they began to burn perfumes: and afterwards men leaving their ancient diet of herbs and roots, and beginning to use living creatures for food, they began also to change their sacrifices. The scriptures, however, furnish us with a different account: for Noah, it is said, sacrificed animals at his coming out of the ark; and even Abel himself sacrificed the best and fattest of his flock; but Grotius thinks it more probable that he contented himself with making a mere oblation of his lambs, &c. without slaying them.

The Jews had two sorts of sacrifices, taking the word in its largest signification: The first were offerings of tythes, first-fruits, cakes, wine, oil, honey, and the like; and the last, offerings of slaughtered animals. When an Israelite offered a loaf or a cake, the priest broke it in two parts; and setting aside that half which he reserved for himself, broke the other into crumbs, poured oil, wine, incense, and salt upon it, and spread the whole upon the fire of the altar. If these offerings were accompanied with the sacrifice of an animal, they were thrown upon the victim to be consumed along with it. If the offerings were of the ears of new corn, they were parched at the fire, rubbed in the hand, and then offered to the priest in a vessel, over which he poured oil, incense, wine and salt, and then burnt it upon the altar, having first taken as much of it as of right belonged to himself.

The principal sacrifices among the Hebrews consisted of bullocks, sheep, and goats; but doves and turtles were accepted from those who were not able to bring the other; these beasts were to be perfect, and without blemish. The rites of sacrificing were various, all of which are very minutely described in the books of Moses.

The manner of sacrificing among the Greeks and Romans was as follows. In the choice of the victim, they took care that it was without blemish or imperfection; its tail was not to be too small at the end; the tongue not black, nor the ears cleft; and that the bull was one that had never been yoked. The victim being pitched upon, they gilt his forehead and horns, especially if a bull, heifer, or cow. The head they also adorned with a garland of flowers, a woollen infula or holy fillet, whence hung two rows of chaplets with twisted ribbands; and on the middle of the body a kind of stole, pretty large, hung down on each side; the lesser victims were only adorned with garlands and bundles of flowers, together with white tufts or wreaths.

The victims thus prepared were brought before the altar; the lesser being driven to the place, and the greater led by an halter; when if they made any struggle, or refused to go, the resistance was taken for an ill omen, and the sacrifice frequently was set aside. The victim thus brought was carefully examined, to see that there was no defect in it: then the priest, clad in his sacerdotal habit, and accompanied with the sacrificers and other attendants, and being washed and purified according to the ceremonies prescribed, turned to the right-hand and went round the altar, sprinkling it with meal and holy-water, and also besprinkling those who were present. Then the crier proclaimed with a loud voice, Who is here? To which the people replied, Many and good. The priest then having exhorted the people to join with him by saying, Let us pray, confessed his own unworthiness, acknowledging that he had been guilty of divers sins; for which he begged pardon of the gods, hoping that they would be pleased to grant his requests, accept the oblations offered them, and send them all health and happiness; and to this general form added petitions for such particular favours as were then desired. Prayers being ended, the priest took a cup of wine; and having tasted it himself, caused his assistants to do the like; and then poured forth the remainder between the horns of the victim. Then the priest or the crier, or sometimes the most honourable person in the company, killed the beast,

by

by knocking it down, or cutting its throat. If the sacrifice was in honour of the celestial gods, the throat was turned up towards heaven; but if they sacrificed to the heroes or infernal gods, the victim was killed with its throat towards the ground. If by accident the beast escaped the stroke, leaped up after it, or expired with pain and difficulty, it was thought to be unacceptable to the gods. The beast being killed, the priest inspected its entrails, and made predictions from them. They then poured wine, together with frankincense, into the fire, to increase the flame, and then laid the sacrifice on the altar; which in the primitive times was burnt whole to the gods, and thence called an holocaust; but in after-times, only part of the victim was consumed in the fire, and the remainder reserved for the sacrificers; the thighs, and sometimes the entrails, being burnt to their honour, the company feasted upon the rest. While the sacrifice was burning, the priest, and the person who gave the sacrifice, jointly prayed, laying their hands upon the altar. Sometimes they played upon musical instruments in the time of the sacrifice, and on some occasions they danced round the altar, singing sacred hymns in honour of the gods.

**SACRIFICE**, is also a name of an island in the gulph of Mexico, forty-five miles east of La Vera Cruz; it is subject to the Spaniards.

**SACRILEGE**, the crime of profaning sacred things, or those devoted to the service of God.

**SACRISTAN**, a church-officer, otherwise called sexton. See **SEXTON**.

**SACRISTY**, in church history, an apartment in a church, where the sacred utensils were kept; being the same with our vestry. See **VESTRY**.

**SACRO LUMBARIS**, in anatomy. See **ANATOMY**, p. 203.

**SACRUM** os See **ANATOMY**, p. 170.

**SADERASAPATAN**, a port-town of the coast of Comandel forty miles south of Fort St George. Here the Dutch have a factory.

**SADDLE**, is a seat upon a horse's back, contrived for the convenience of the rider.

A hunting saddle is composed of two bows, two bands, fore-bolsters, pannels, and saddle-straps; and the great saddle has, besides these parts, corks, hind-bolsters, and a trousséquin.

The pommel is common to both.

**SADDUCEES**, in Jewish antiquity, a famous sect among the ancient Jews, so called from their founder Sadoc. Antigonus of Socho, president of the sanhedrim at Jerusalem, and teacher of the law in the divinity school of that city. Having often, in his lectures, asserted to his scholars, that they ought not to serve God in a servile manner, with respect to reward, but only out of filial love and fear; two of his scholars, Sadoc and Baithus, inferred from thence, that there were no rewards or punishments after this life; and, therefore, separating from the school of their master, they taught that there was no resurrection, nor future state. Many embracing this opinion, gave rise to the sect of the Sadducees, who were a kind of Epicureans; but differing from them in this, that though they denied a future state, yet they allowed the world was created by the power of God, and governed by his providence; whereas the followers of Epicurus denied both.

The Sadducees denied all manner of predestination whatever; and not only rejected all unwritten traditions, but also all the books of the Old Testament, excepting the Pentateuch.

**SAFE GUARD**, a protection formerly granted to a stranger, who feared violence from some of the king's subjects, for seeking his right by course of law.

**SAFFRON**, in botany, &c See **CROCUS**.

*Meadow SAFFRON*, in botany. See **COLCHICUM**.

**SAGAPENUM**, in pharmacy, &c. a gum-resin, brought to us in two forms: the finer and purer is in loose granules, or single drops: the coarser kind is in masses composed of these drops of various sizes, cemented together by a matter of the same kind. In either case, it is of a firm and compact substance, considerably heavy, and of a reddish colour on the outside, brownish within, and spotted in many places with small yellowish or whitish specks. Its smell is strong and disagreeable: its taste acrid and unpleasent.

It is brought to us from Persia and the East-Indies.

**Sagapenum** is a very great attenuant, aperient, and discutient; it is good in all disorders of the breast that owe their origin to a tough phlegm.

**SAGE**, in botany. See **SALVIA**.

**SAGENE**, a Russian long measure, five hundred of which make a werst: the sagene is equal to seven English feet.

**SAGINA**, in botany, a genus of the tetrandria tetragynia class. The calix consists of four leaves, and the corolla of four petals; the capsule has four cells, and four valves, containing many seeds. There are three species, two of them natives of Britain, *viz.* the procumbens, or pearl wort; and the erecta, or the least stitch wort.

**SAGITTA**, in astronomy. See **ASTRONOMY**, p. 487.

**SAGITTAL SUTURE**, in anatomy. See **ANATOMY**, p. 152.

**SAGITTARIA**, in botany, a genus of the monœcia polyandria class. The calix of the male consists of three segments, and the corolla of three petals; and the stamina are about 24. The calix and corolla of the female are the same with those of the male; it has no pistillum; and the seeds are many, and naked. The species are four, only one of them, *viz.* the sagittifolia, or arrow head, a native of Britain.

**SAGITTARIUS**, in astronomy. See **ASTRONOMY**, p. 487.

**SAGO**, a simple brought from the East-Indies, of considerable use in diet as a restorative.

Sago is a sort of bread produced in the following manner, from a tree called landan, growing in the Moluccos. When a tree is felled, they cleave it in two in the middle, and dig out the pith, which is eatable, when it comes fresh out of the tree. They pound it in a mortar, till it is reduced into a kind of powder somewhat like meal. Then they put in a searer, made of the bark of the same tree, placing it over a cistern made of its leaves, and pour water on it, which separates the pure part of the powder from the woody fibres wherewith the pith abounds. The flour thus filtrated they call sago, which they make into paste, and bake it in earthen furnaces.

**SAGREE**, in ichthyology. See **SQUALUS**.

**SAICK**, or **SATIQUE**, a Turkish vessel, very common in the Levant for carrying of merchandize.

**SAIL**, in navigation, an assemblage of several breadths of

canvas, sewed together by the lists, and edged round with a cord, fastened to the yards of a ship, to make it drive before the wind. See SHIP.

**SAILING**, properly denotes the art of navigating and working a ship, or of causing her to observe such motions and directions as are assigned by the navigator; in which sense, sailing differs from navigation, and must be learned by practice on shipboard. See NAVIGATION.

**SAINT**, in the Romish church, a holy person deceased, and since his decease canonized by the pope, after several informations and ceremonies. See CANONIZATION.

**SAINT POIN**, in botany. See HEDYSARUM, and AGRICULTURE, p. 65.

**SAL**, one of the islands of cape Verd, situated in the Atlantic ocean: W. long.  $23^{\circ}$ , lat.  $17^{\circ}$ .

**SALAMANCA**, a city of Spain in the province of Leon, situated on the river Tormes: W. long.  $6^{\circ} 10'$ , N. lat.  $41^{\circ}$ .

**SALAMANDER**, in zoology. See LACERTA.

**SALAMIS**, an island in the gulph of Engia, in European Turkey, situated in E. long.  $34^{\circ}$ , N. lat.  $37^{\circ} 32'$ , being about fifty miles in circumference.

**SALEM**, a port-town of New England, a little north of Boston.

**SALEP**, in the materia medica, the root of a species of orchis. See ORCHIS.

Salep should be chosen clean, firm and hard: it is very little liable either to decay or sophistication. The salep differs very little from the common orchis in virtue. Its appearance is owing to the manner of preparing it, and consequently this may be done from the roots of orchis of our own growth. To prepare these in imitation of salep, Mr. Geoffroy chose the largest, fairest, and plumpest roots he could find: these he nicely skinned; then throwing them into cold water, he suffered them to macerate there for some time: after this he lightly boiled them, and then taking them out of the water and draining them, he had them strung upon threads to be dried in a warm dry air: when the roots were thoroughly dried, they were very transparent, and resembled pieces of tragacanth, and continued dry and hard. The roots thus prepared may be reduced to powder, which will dissolve away in boiling water; and a scruple of it will make a basin full of jelly, in the manner of the Turkish salep. This jelly is an admirable medicine in all cases in which salep is prescribed; and the powder may be given with great success in asses-milk for diseases of the breast.

**SALERNO**, a city and port-town of Italy, in the kingdom of Naples and the hither principate, situated on a bay of the Tuscan sea: E. long.  $15^{\circ} 20'$ , N. lat.  $40^{\circ} 40'$ .

**SALET**, in war, a light covering or armour for the head, anciently worn by the light horse, only differing from the casq in that it had no crest, and was little more than a bare cap.

**SALIENT**, in fortification, denotes projecting. There are two kinds of angles, the one salient, which are those that present their point outwards; the other re-entering, which have their points inwards. See FORTIFICATION.

**SALIENT**, **SALIENT**, or **SAILLANT**, in heraldry, is applied to a lion, or other beast, when its fore-legs are raised in a leaping posture. See Plate CXLVII. fig. 14.

**SALIC**, or **SALIQUE LAW**, an ancient and fundamental law of the kingdom of France, usually supposed to have

been made by Pharamond, or at least by Clovis, in virtue whereof males are only to inherit.

**SALICORNIA**, in botany, a genus of the monandria monogynia class. The calix is ventricose and entire; it has no corolla, and but one seed. The species are four, only one of them, viz. the europæa, or marsh samfire, a native of Britain.

**SALII**, in Roman antiquity, priests of Mars, whereof there were twelve, instituted by Numa, wearing painted particoloured garments and high bonnets, with a steel-cuirasse on the breast. They were called salii from *saltare*, to dance; because, after assisting at sacrifices, they went dancing about the streets, with bucklers in the left hand, and a rod in the right, striking musically on one another's bucklers with their rods, and singing hymns in honour of the gods.

**SALINA**, anciently Salamis, a port-town of the island of Cyprus, situated on the south side of the island, in E. long.  $34^{\circ} 30'$ , and N. lat.  $34^{\circ} 30'$ .

**SALINE**, a name given to a preparation of sea-salt, procured from the froth of the sea, hardened by the sun in hot countries. It is called by some authors *pilatro de Levante*, and is used in glass-making; and in the making the fine purple colour from cochineal, by boiling it in a small quantity, with the bran and sœvengreek, of which the magifery is made for that purpose.

**SALISBURY**, the capital city of Wiltshire, situated eighty miles west of London, and thirty-five miles south-east of Bristol. It sends two members to parliament.

**SALIVA**, **SPITTLE**, a thin pellucid humour, separated from the arterial blood, by the glands about the mouth and fauces, and conveyed, by proper salival ducts, into the mouth, for several uses. See ANATOMY, p. 307.

**SALIVAL**, an epithet applied to the glands and ducts which supply and secrete the saliva. See ANATOMY, p. 307.

**SALIVATION**, in medicine, a promoting of the flux of saliva, by means of medicines, mostly by mercury. The chief use of salivation is in diseases belonging to the glands and the membrana adiposa, and principally in the cure of the venereal disease, though it is sometimes also used in epidemic diseases, cutaneous diseases, &c. whose crises tend that way. See MEDICINE.

**SALIX**, in botany, a genus of the diœcia diandria class. The amentum of both male and female consists of scales; none of them have any corolla; the stylus is bifid; the capsule has but one cell, and two valves; and the seeds are pappous. There are 31 species, 18 of them natives of Britain.

**SALÉE**, a port-town of the empire of Morrocco, in the kingdom of Fez, situated on the coast of the Atlantic ocean: W. long.  $7^{\circ}$ , and N. lat.  $34^{\circ}$ .

**SALLY**, in the military art, the issuing out of the besieged from their town or fort, and falling upon the besiegers in their works, in order to cut them off, nail their cannon, hinder the progress of their approaches, destroy their works, &c.

**SALMO**, in ichthyology, a genus belonging to the order of abdominales: The head is smooth, and furnished with teeth, and a tongue; the rays of the gills are from four to ten; the back-fin is fat behind; and the belly-fins have many rays. There are 29 species.

**SALMON-FISHING**. See FISHERY.

SALOON,

**SALOON**, in architecture, a very lofty spacious hall, vaulted at top, and sometimes comprehending two stories or ranges of windows.

**SALONICHI**, a city and port-town of Macedon, in Turkey, anciently called Thessalonica, two hundred and sixty miles west of Constantinople: E. long. 24°, N. lat. 41°.

**SALPA**, in ichthyology. See **SPARUS**.

**SALSETTE**, an island on the western coast of the hither India, separated from that of Bombay by a narrow channel: it belongs to the Portuguese, and is twenty miles long, and seventeen broad.

**SALSOLA**, in botany. See **KALI**.

**SALT**, the name of a series or subdivision of fossils, naturally and essentially simple, not inflammable, and soluble in water. See **CHEMISTRY**, p. 122, &c.

**SALTIER**, in heraldry, an ordinary in form of a St. Andrew's cross; which may be said to be composed of a bend dexter and sinister, crossing each other in the centre of the escutcheon. See Plate CXLVII fig. 15.

**SALT-PETRE**. See **NITRE**.

**SALTSBURG**, the capital of an archbishopric of the same name, in Bavaria, situated on the river Saltza, seventy miles east of Munich: E. long. 13°, N. lat. 47° 45'.

**SALVADORA**, in botany, a genus of the tetrandria monogynia class. The calix has four segments; it has no corolla; the berry contains but one seed, furnished with an ann. There is one species, a native of India.

**SALVAGE-MONEY**, a reward allowed by the civil and statute law, for the saving of ships or goods from the danger of the seas, pirates, or enemies.

Where any ship is in danger of being stranded, or driven on shore, justices of the peace are to command the constables to assemble as many persons as are necessary to preserve it; and on its being preserved by their means, the persons assisting therein shall in thirty days after be paid a reasonable reward for their salvage, otherwise the ship or goods shall remain in the custody of the officers of the customs as a security for the same.

**SALVIA**, in botany, a genus of the diandria monogynia class. The corolla is unequal; and the filaments fixed transversely to a pedicle. There are 32 species, two of them natives of Britain, viz. the pratensis, or meadow-clary; and the verbera, or wild-clary.

**SALUTATION**, the act of saluting, greeting, or paying respect and reverence to any one.

There is a great variety in the forms of salutation. The orientals salute by uncovering their feet, laying their hands on their breasts, &c. In Britain, we salute by uncovering the head, bending the body, &c. The pope makes no reverence to any mortal, except the emperor, to whom he stoops a very little, when he permits him to kiss his lips.

**SALUZZO**, a city of Italy, the capital of a marquisate of the same name in Piedmont, seventeen miles south of Turin.

**SAMARCAND**, a city of Ussac Tartary, formerly its capital: E. long. 66°, N. lat. 40°.

**SAMARIA**, an ancient city of Palestine, in Asiatic Turkey, forty five miles north of Jerusalem.

**SAMARITANS**, an ancient sect among the Jews, still existing in some parts of the Levant, under the same name.

Its origin was in the time of Rehoboam, under whose

reign the people of Israel were divided into two distinct kingdoms, that of Judah and that of Israel; when the capital of the latter being Samaria, the Israelites obtained the name of Samaritans.

They were anciently guilty of idolatry, and the rabbins pretend, that they worshipped the figure of a dove on mount Gerizim; but the present Samaritans, who are but few in number, are far from being idolaters. They celebrate the passover every year, on the fourteenth day of the first month, on mount Gerizim, and begin that feast with the sacrifice appointed for that purpose in Exodus: they keep the sabbath with all the rigour with which it is enjoined in the book of Exodus, none among them stirring out of doors but to the synagogue: they sacrifice nowhere but on mount Gerizim: they observe the feasts of expiation, tabernacles, harvest, &c. and never defer-circumcision beyond the eighth day; they never marry their nieces, as the Jews do; have but one wife; and in fine, do nothing but what is commanded in the law.

**SAMBALLAS**, or **SAMBLAS ISLANDS**, several islands situated in the American ocean, near the coast of Darien, none of which are inhabited: E. long. 81°, N. lat. 10°.

**SAMBUCUS**, in botany, a genus of the pentandria trigynia class. The calix and corolla consist of five segments; and the berry contains three seeds. There are four species, two of them natives of Britain, viz. the nigra, or common elder; and the ebulus, or dwarf elder.

The inner green bark of this shrub is gently cathartic.

**SAMIAN EARTH**, in the materia medica, the name of two species of marle used in medicine, viz. 1. The white kind, called by the ancients collyrium samium; being astringent, and therefore good in diarrhæas, dysenteries, and hæmorrhages; they also used it externally in inflammations of all kinds. 2. The brownish-white kind, called after samius, by Dioscorides: this also stands recommended as an astringent.

**SAMOGITIA**, a maritime province of Poland, bounded by Courland on the north, and by the Baltic on the west.

**SAMOIDA**, the most northerly province of Russia in Europe, situated on the frozen ocean, and the river Oby.

**SAMOLUS**, in botany, a genus of the pentandria monogynia class. The corolla is rotated; the stamina are tortified by scales; and the capsule has one cell. There is but one species, viz. the valerandi, or round-leaved water pimpnel, a native of Britain.

**SAMOS**, a fertile island of the Archipelago, thirty miles south of Smyrna: E. long. 27° 30', N. lat. 37° 30'.

**SAMOTHRA CIA**, a small island in the Egean sea, near the coast of Thrace.

**SAMPSEANS**, in church-history, an ancient sect, who were properly neither Jews, Christians, nor Gentiles, though they took their name from the Hebrew word *se-mes*, sun; as though they worshipped that planet.

They acknowledged only one God; washed themselves often, and in almost every thing attached themselves to the religion of the Jews.

**Books of SAMUEL**, two canonical books of the Old Testament, so called as being usually ascribed to the prophet Samuel.

The books of Samuel, and the books of Kings, are a continued history of the reigns of the Kings of Israel and Judah; for which reason the books of Samuel are likewise

wife styled the first and second books of Kings. Since the first twenty-four chapters contain all that relates to the history of Samuel, and the latter part of the first book, and all the second, include the relation of events that happened after the death of that prophet, it has been supposed that Samuel was author only of the first twenty-four chapters, and that the prophets Gad and Nathan finished the work. The first book of Samuel comprehends the transactions under the government of Eli, and Samuel; and under Saul, the first king; and also the acts of David, whilst he lived under Saul, and is supposed to include the space of a hundred and one years. The second book contains the history of about forty years, and is wholly spent in relating the transactions of king David's reign.

**SAMYDA**, in botany, a genus of the decandria monogynia class. The calix consists of five coloured leaves; it has no corolla; and the berry has three valves, and one cell. There are five species, none of them natives of Britain.

**SANCTIFICATION**, the act of sanctifying, or rendering a thing holy.

The reformed divines define sanctification to be an act of God's grace, by which a person's desires and affections are alienated from the world, and by which he is made to die to sin, and to live to righteousness; or, in other words, to feel an abhorrence of all vice, and a love of virtue and religion.

**SANCTION**, the authority given to a judicial act, by which it becomes legal and authentic.

**SANCTUARY**, among the Jews, also called *Sanctum sanctorum*, or Holy of holies, was the holiest and most retired part of the temple of Jerusalem, in which the ark of the covenant was preserved, and into which none but the high priest was allowed to enter, and that only once a year, to intercede for the people. Some distinguish the sanctuary from the *sanctum sanctorum*, and maintain that the whole temple was called the sanctuary.

To try and examine any thing by the weight of the sanctuary, is to examine it by a just and equal scale: because, among the Jews, it was the custom of the priests to keep stone weights, to serve as standards for regulating all weights by, though these were not at all different from the royal, or profane weights.

Sanctuary, in the Romish church, is also used for that part of the church in which the altar is placed, encompassed with a rail or balustrade.

**SANCTUARY**, in our ancient customs, is the same with *Asylum*. See **ASYLUM**.

**SAND**, in natural history, a genus of fossils, the characters of which are, that they are found in minute concretions; forming together a kind of powder, the genuine particles of which are all of a tendency to one determinate shape, and appear regular, though more or less complex concretions; not to be dissolved or disunited by water, or formed into a coherent mass by means of it, but retaining their figure in it; transparent, vitrifiable by extreme heat, and not dissoluble in, nor effervescing with, acids. Sands are subject to be variously blended both with homogene and heterogeneous substances, as that of talcs, &c. and hence, as well as from their various colours, are subdivided into a number of species.

**SAND-BAGS**, in the art of war, are bags filled with earth or sand, holding each about a cubic foot: their use is to

raise parapets in haste, or to repair what is beaten down. **SANDECK**, a town of little Poland, thirty-five miles south-east of Cracow.

**SAND-EEL**, *ammodytes*, in ichthyology. See **AMMODYTES**.

**SANDAL**, in antiquity, a rich kind of slipper worn on the feet by the Greek and Roman ladies, made of gold, silk, or other precious stuff, consisting of a sole, with an hollow at one extreme to embrace the ankle, but leaving the upper part of the foot bare.

Sandal, is also used for a shoe or slipper worn by the pope, and other Romish prelates, when they officiate. It is also the name of a sort of slipper worn by several congregations of reformed monks. This last consists of no more than a mere leathern sole, fastened with latches or buckles, all the rest of the foot being left bare. The capuchins wear sandals; the recolects, clogs: the former are of leather, and the latter of wood.

**SANDARACH**, in natural history, a very beautiful native fossil, though too often confounded with the common factitious red arsenic, and with the red matter formed by melting the common yellow orpiment.

It is a pure substance, of a very even and regular structure, is throughout of that colour which our dyers term an orange-scarlet, and is considerably transparent even in the thickest pieces. But though, with respect to colour, it has the advantage of cinnabar while in the mass, it is vastly inferior to it when both are reduced to powders. It is moderately hard, and remarkably heavy, and, when exposed to a moderate heat, melts and flows like oil: if set on fire, it burns very briskly.

It is found in Saxony and Bohemia, in the copper and silver mines; and is sold to the painters, who find it a very fine and valuable red: but its virtues or qualities in medicine, are no more ascertained at this time, than those of the yellow orpiment.

**Gum-SANDARACH**, is a dry and hard resin, usually met with in loose granules, of the bigness of a pea, a horse-bean, or larger; of a pale whitish yellow, transparent, and of a resinous smell, brittle, very inflammable, of an acrid and aromatic taste, and diffusing a very pleasant smell when burning. It is produced from a species of the juniper.

It flows only from these trees in hot countries; but the natives promote its discharge by making incisions in the bark.

Sandarach is good in diarrhoeas, and in hæmorrhages.

The varnish-makers make a kind of varnish of it by dissolving it in oil of turpentine or linseed, or in spirit of wine.

**SANDIVER**, a whitish salt, continually cast up from the metal, as it is called, whereof glass is made; and, swimming on its surface, is skimmed off.

Sandiver is also plentifully thrown out in the eruptions of volcanos; some is of a fine white, and others tinged bluish or yellowish.

Sandiver is detergent, and good for foulnesses of the skin. It is also used by gilders of iron.

**SANDIX**, a kind of minium, or red-lead, made of ceruse, but much inferior to the true minium.

**SANDWICH**, one of the cinque-ports, in Kent, ten miles east of Canterbury: it sends two members to parliament, and gives the title of Earl to the noble family of Montague.

**SANGUI-**

**SANGUIFICATION**, in the animal œconomy, the conversion of chyle into true blood. See **CHYLE**.

**SANGUINARIA**, **BLOOD-WORT**, in botany, a genus of the polyandria monogynia class. The corolla consists of eight petals, and the calix of two leaves; the pod is oval, with one cell. There is but one species, a native of America.

**SANGUINE**, in general, something abounding with, or resembling blood. See **BLOOD**.

**SANGUIS**. See **BLOOD**.

**SANGUISORBA**, in botany, a genus of the tetrandria monogynia class. The calix has two leaves; and the germen is situate between the calix and corolla. There are three species, only one of them, *viz.* the officinalis, or burnet, a native of Britain, the leaves of which are mildly astringent.

**SANHEDRIM**, among the Jews, the great council of the nation, consisting of seventy senators, taken partly from among the priests and levites, and partly out of the inferior judges, who formed what was called the lesser sanhedrim. The room they met in was a rotunda, half of which was built without the temple, and half within. The nasi, or president of the sanhedrim, sat upon a throne, with his deputy on his right hand, his sub-deputy on his left, and the other senators ranged in order on each side.

The authority of this council was very extensive: for they decided such causes as were brought before them by way of appeal from the inferior courts; and the king, the high-priests, and prophets, were under the jurisdiction of this tribunal. They had the right of judging in capital cases, and sentence of death might not be pronounced in any other place; for which reason the Jews were forced to quit this hall, when the power of life and death was taken out of their hands, forty years before the destruction of the temple, and three years before the death of Christ.

There were several inferior sanhedrims in Palestine, each of which consisted of twenty three persons; all these depended on the great sanhedrim of Jerusalem.

**SANICULA**, in botany, a genus of the pentandria digynia class. The umbellæ are thick; the fruit is rough; and the flowers of the disk are abortive. The species are three, only one of them, *viz.* the europæa, or fanicle, is a native of Britain. The leaves are supposed to be vulnerary.

**SANIDIUM**, in natural history, the name of a genus of fossils, of the class of the selenitæ, but neither of the rhomboidal nor columnar kinds, nor any other way distinguishable by its external figure, being made up of several plain flat plates.

**SANIES**, in medicine, a ferous putrid matter, issuing from wounds; it differs from pus, which is thicker and whiter.

**SANQUHAR**, a borough-town of Scotland, in the county of Nithsdale, twenty-one miles north of Dumfries.

**SANTA CLARA**, an island in the Pacific Ocean, situated in the bay of Guayquil: W. long. 80°, S. lat. 3° 15'.

**SANTA CRUZ**, a port-town on the north side of the island of Cuba, in North America: W. long. 85° 30', N. lat. 22° 30'.

**SANTA FE**, the capital of New Mexico: W. long. 109°, N. lat. 36°.

**SANTA FE DE BAGOTA**, the capital of Terra Firma, in South America: W. long. 74°, N. lat. 4° 30'.

**SANTA MARIA**, a town of Terra Firma, in the province of Darien, situated on a river of the same name, a little east of the bay of Panama: W. long. 80°, N. lat. 7° 40'.

**SANTALUM**, in botany, a genus of the octandria monogynia class. The corolla consists of one petal; the stamina lie upon the tube; the stigma is simple; and the fruit is a berry. There is but one species, a native of India. The wood is reckoned to be attenuant and cordial.

**SANTILLANA**, a city and port-town of Spain, the capital of the eastern Asturia, situated on the bay of Biscay: W. long. 5°, and N. lat. 43° 35'.

**SANTOLINA**, a genus of the syngenesia polygamia æqualis class. The receptacle is paleaceous; the pappus is very short; and the calix is hemispherical and imbricated. The species are four, none of them natives of Britain.

**SANTORINI**, an island of the Archipelago, thirty-five miles in circumference: E. long. 25° 35', N. lat. 36° 10'.

**SAONE**, a river of France, which rises in Lorraine, and falls into the Rhone at Lyons.

**SAP**, a juice furnished by the earth, and changed into the plant. See **AGRICULTURE**, p. 45.

**SAPHENA**, in anatomy. See **ANATOMY**, p. 243.

**SAPIENZA**, an island and cape in the mediterranean sea, on the south-west point of the Morea, E. long. 21° 15', N. lat. 36° 45'.

**SAPPIC**, in poetry, a kind of verse much used by the Greeks and Latins, denominated from the inventress Sappho. The Sapphic verse consists of five feet, whereof the first, fourth, and sixth are trochees, the second a spondee, and the third a dactyl.

**SAPINDUS**, in botany, a genus of the octandria digynia class. The calix consists of four leaves; and the corolla of four petals; and there are three round, connate; ventricose capsules. The species are three, none of them natives of Britain.

**SAPO**. See **SOAP**.

**SAPONARIA**, in botany, a genus of the decandria digynia class. The calix consists of one leaf, and the corolla of five clawed petals; and the capsule is oblong; with one cell. There are six species, only one of them, *viz.* the officinalis, or soap-wort, a native of Britain. The root of this species is supposed to be aperient, corroborant, and sudorific.

**SAPPHIRE**, a pellucid gem, which, in its finest state, is extremely beautiful and valuable, and second only to the diamond in lustre, hardness, and price. Its proper colour is a pure blue; in the finest specimens it is of the deepest azure, and in others varies into paleness in shades of all degrees, between that and a pure crystal brightness and water, without the least tinge of colour, but with a lustre much superior to the crystal. They are distinguished into four sorts, *viz.* the blue sapphire, the white sapphire, the water sapphire, and the milk sapphire.

The gem known to us by this name is extremely different from the sapphire of the ancients, which was only a semi-opaque stone, of a deep blue, veined with white, and spotted with small gold-coloured spangles, in the form of stars, and was only a more beautiful kind of the lapis lazuli: but our sapphire they have described under the name of beryllus aeroides, or the sky-blue beryl.

The finest sapphires in the world are brought from the kingdom

kingdom of Pegu in the East-Indies, where some are found perfectly colourless, and others of all the shades of blue; these are all found in the pebble-form. We have very fine sapphires also, partly pebble, partly crystal-shaped, from Bishnagar, Conanor, Calicut, and the island of Ceylon: these also are of all the shades of blue. And in Ceylon there are sometimes found a sort of bastard gems, of a mixed nature between the sapphire and ruby. The occidental are from Silesia, Bohemia, and many other parts of Europe; but though these are often very beautiful stones, they are greatly inferior, both in lustre and hardness, to the oriental.

**SAPPHIRINE WATER**, in the materia medica, also called blue eye-water, is thus prepared: Pour a pint of lime-water, made strong and fresh, into a copper-vessel, add to it a dram of crude sal armoniac, and throw in some filings or small pieces of copper, and let it stand till it has acquired a beautiful colour.

This is used as an eye-water; as also to deterge old ulcers: and sometimes it is mixed with other things in injections in gonorrhoeas.

**SARABAITES**, a sort of monks among the ancient christians, who did not resort to the wilderness as others did, but lived publicly in cities. Two or three of them usually dwelt together, but they had no rule or government; they however observed very strict fasts; wore loose sleeves, wide stockings, coarse clothes, frequently sighed, and always bitterly inveighed against the clergy.

**SARABAND**, a musical composition in triple time, the motions of which are slow and serious.

**SARACENS**, the inhabitants of Arabia; so called from the word *sara*, which signifies a desert, as the greatest part of Arabia is: and this being the country of Mahomet, his disciples were called Saracens.

**SARAGOSSA**, the capital of the province of Arragon in Spain: W. long  $1^{\circ} 15'$ , and N. lat.  $41^{\circ} 32'$ .

**SARCASM**, in rhetoric, a keen bitter expression which has the true point of satire, by which the orator scoffs and insults his enemy: such was that of the Jews to our Saviour, "He saved others, himself he cannot save."

**SARCOCELE**, in surgery, a spurious rupture, or hernia, wherein the testicle is considerably tumid or indurated, like a scirrhus, or much enlarged by a fleshy excrescence, which is frequently attended with acute pains and sometimes ulceration, so as to degenerate at last into a cancerous disposition. See **SURGERY**.

**SARCOCOLLA**, in pharmacy, a gum-resin, which approaches greatly to the nature of the simple gums.

It is brought to us from Persia and Arabia, in small granules moderately heavy, and of a whitish, brownish, or reddish colour very friable, of a faintish disagreeable smell, and of an acid and nauseous taste.

Hoffman absolutely condemns the internal use of it. However, it is recommended in ophthalmias, and dissections of a sharp matter upon the eyes; and is generally ordered to be dissolved in milk for this purpose.

**SARCOLOGY** is that part of anatomy which treats of the soft parts, viz. the muscles, intestines, arteries, veins, nerves, and fat. See **ANATOMY**.

**SARCOMA**, in surgery, denotes any fleshy excrescence.

**SARCOPHAGOUS MEDICINES**, in surgery, &c. are those which at away sound flesh, and otherwise called caustics. See **CAUSTICS**.

**SARCOTICS**, in surgery, medicines which generate flesh in wounds.

**SARDINIA**, an island of the Mediterranean, situated between  $8^{\circ}$  and  $10^{\circ}$  E. long. and between  $39^{\circ}$  and  $41^{\circ}$  N. lat. It is about one hundred and forty miles long, and sixty broad; and gives the title of king to the duke of Savoy, under whose dominion it is.

**SARDIS**, the ancient capital of Lydia, in Asia, now in ruins.

**SARDONYX**, in natural history, a genus of semi pellucid gems, of the onyx structure, zoned or tabulated, and composed of the matter of the onyx variegated with that of the red or yellow carnelian. See **CARNELIAN** and **ONYX**.

**SARGUS**, in ichthyology. See **SPARUS**.

**SARK**, a little island between Guernsey and Jersey, subject to Great Britain.

**SAROTHRA**, in botany, a genus of the pentandria trigynia class. The calix consists of five segments, and the corolla of five petals; the capsule is coloured, and has three cells and one valve. There is but one species, a native of Virginia.

**SARSAPARILLA**, in botany. See **SMLAX**.

**SARTORIUS**, in anatomy. See **ANATOMY**, p. 207.

**SARUM**, or **OLD SARUM**, a borough-town of Wiltshire, situated a little north of Salisbury. It sends two members to parliament.

**SASSAFRAS**, in botany. See **LAURUS**.

The wood is imported in large straight blocks: it is said to be warm, aperient, and corroborant; and frequently employed, with good success, for purifying and sweetening the blood and juices; for which purpose an infusion, in the way of tea, is a very pleasant drink: its oil is very fragrant, and possesses most of the virtues of the wood.

**SATELLITE** in astronomy, the same with a secondary planet, or moon. See **ASTRONOMY**.

**SATRAPA**, or **SATRAPES**, in Persian antiquity, denotes an admiral; but more commonly the governor of a province.

**SATTIN** a glossy kind of silk stuff, the warp of which is very fine, and stands out so as to cover the coarser woof.

**SATTINET**, a slight thin kind of sattin, commonly striped, and chiefly used by the ladies for summer night-gowns.

**SATURANTS**, in pharmacy. See **ABSORBENTS**.

**SATURATION**, in chemistry, is the impregnating an acid with an alkali, or *vice versa*, till either will receive no more, and the mixture will become neutral.

**SATURDAY**, the seventh or last day of the week, so called from the idol Seater, worshipped on this day by the ancient Saxons, and thought to be the same as the Saturn of the Latins.

**SATUREIA** in botany, a genus of the didynamia gymnospermia class. The lacinae of the corolla are nearly equal; and the stamina are approximate. The species are nine, none of them natives of Britain.

The leaves of summer-favory are very pungent, warm, and aromatic; and afford, in distillation with water, a subtle essential oil. Both are esteemed good in crudities of the stomach, asthmas, and menstrual obstructions.

**SATURN**, in astronomy. See **ASTRONOMY**, p. 442.

**SATURN**,

**SATURN**, in chemistry, &c. an appellation given to lead: See **CHEMISTRY**, p. 84, 136.

**SATURN**, in heraldry, denotes the black colour, in blazoning the arms of sovereign princes.

**SATURNALIA**, in Roman antiquity, a festival observed about the middle of December, in honour of the god Saturn, whom Lucan introduces giving an account of the ceremonies observed on this occasion thus: "During my whole reign which lasts but for one week, no public business is done; there is nothing but drinking, singing, playing, creating imaginary kings, placing servants with their masters at table, &c. There shall be no disputes, reproaches &c. but the rich and poor, masters and slaves, shall be equal." &c.

On this festival the Romans sacrificed bare-headed, contrary to their custom at other sacrifices.

**SATURNINE**, an appellation given to persons of a melancholy disposition, as being supposed under the influence of the planet saturn

**SATYRE**, in the heathen mythology, a fabulous kind of demi-god, or rural deity, of the ancient Romans, represented with goat's feet, and sharp-pricked up ears.

**SATYR**, or **SATIRE**, in matters of literature, a discourse or poem exposing the vices and follies of mankind.

The chief satyrists among the ancients are Horace, Juvenal, and Persius; those among the moderns, Regnier, and Boileau, in French; and Dryden, Oldham, Rochester, Buckingham, Pope, Young, &c. among the English.

**SATYRIUM**, a genus of the gynandria diandria class. The nectarium resembles a scrotum, placed behind the flower. The species are eight, 4 of them natives of Britain.

**SAVANNA**, a town and river of Georgia, in North-America: W. long. 81° 20', N lat. 32°.

**SAUCISSE**, or **SAUSAGE**, in the military art, a long train of powder, sewed up in a roll of pitched cloth, about two inches in diameter, serving to set fire to mines.

**SAUCISSON**, in fortification, a mass of large branches of trees bound together; and differing only from a fascine, as this is composed of small branches of twigs.

Saucissons are employed to cover the men, and to make epauléments.

**SAVE**, a large river of Germany, which rising in Carinthia, runs east through Carniola and Croatia, and dividing Slavonia from Turkey, discharges itself into the Danube at Belgrade.

**SAVIN**, in botany. See **JUNIPERUS**.

**SAVIOUR**, an appellation peculiarly given to Jesus Christ, as being the true Messiah, and Saviour of the world.

*Order of St Saviour* a religious order in the Romish church, founded by St Bridget, about the year 1345; and so called from its being pretended that our Saviour himself dictated to the foundress its constitutions and rules.

According to the constitutions, this order is principally founded for religious women who pay a particular honour to the Holy virgin: but there are some monks of the order, to administer the sacraments, and spiritual assistance to the nuns.

**SAUMUR**, a city of France, in the province of Orleans, and duchy of Anjou; twenty-four miles east of Anjou.

**SAUNDERS**. See **SANTALUM**.

**SAVOLAXIA**, a subdivision of Finland, in Russia, situated between Cajania, Kexholm, Carelia, and Bothnia.

**SAVORY**, in botany. See **SATUREIA**.

**SAVOUR**. See **TASTE**.

**SAVOY**, a duchy, situated between France and Italy, on the west side of the Alps; bounded by the lake and territory of Geneva, on the north; by Switz-land and Piedmont, on the east; by another part of Piedmont and Dauphine, on the south; and by Franche Compté and Dauphine, on the west.

**SAUVAGESIA**, in botany, a genus of the pentandria monogynia class. The calix consists of five leaves, and the corolla of five fimbriated petals; the nectarium has five leaves, lying alternately between the petals; and the capsule has one cell. There is but one species; a native of Jamaica.

**SAW**, an instrument which serves to cut into pieces several solid matters, as wood, stone, ivory &c.

The best saws are of tempered steel ground bright and smooth: those of iron are only hammer hardened; hence, the first, besides their being stiffer, are likewise found smoother than the last. They are known to be well hammered by the stiff bending of the blade; and to be well and evenly ground, by their bending equally in a bow.

**SAW-FISH**. See **SQUALUS**.

**SAXIFRAGA**, in botany, a genus of the decandria digynia class. The calix consists of five segments, and the corolla of five petals; the capsule has a double beak and one cell. The species are 38 nine of them natives of Britain.

The tuberosities at the root of the granulata or white-flowered saxifrage are kept in the shops, under the name of saxifrage seeds; they are diuretic and attenuant; and therefore good in nephritic cases and obstructions of the menfes and viscera.

**SAXONY**, the name of two circles of the German empire, distinguished by the epithets Upper and Lower. The circle of Upper Saxony comprehends the duchy of Saxony, the marquisates of Misnia, Lusatia, and Brandenburg, and the duchies of Pomerania, Sax-Hall, Sax-Altemburg, Sax-Meisburg, and Sax-Naumburg. The circle of Lower Saxony comprehends the duchies of Mecklenburg, Holstein, Lawenburg, Luenenburg, Zell, Bremen, Brunswic, Hanover, and Magdeburg; the principalities of Verden and Halberlat, and the bishoprick of Hildesheim.

**SAY**, or **SAYE**, in commerce, a kind of serge or woollen stuff much used abroad for linings, and by the religious for shirts: with us it is used for aprons by several sorts of artificers, being usually dyed green.

**SCABIOSA**, in botany, a plant of the tetrandria monogynia class. The common calix consists of many leaves, and the proper one is double; the receptacle is paleaceous. The species are 25, three of them natives of Britain, viz. the succisa, or devil's bit; the arvensis, or common field scabious; and the columbaria, or lesser field scabious.

**SCAFFOLD**, among builders, an assemblage of planks and boards, sustained by tressels and pieces of wood fixed in the wall; whereon masons, brick layers, &c. stand to work in building high walls, &c. and plasterers in plastering ceilings, &c.

Scaffold also denotes a timber-work raised in the manner of an amphitheatre, for the more commodious viewing any shew or ceremony: it is also used for a little stage, raised in some public place, whereon to behead criminals.

SCAGEN, a promontory of North Jutland, at the entrance of the Scagerrack sea, or passage out of the ocean into the Baltic sea: E. lon. 10°, N. lat. 58°.

SCALADO, or SCALADE, in the art of war, a furious assault made on the wall or rampart of a city, or other fortified place, by means of ladders, without carrying on works in form to secure the men.

SCALE, a mathematical instrument, consisting of several lines drawn on wood, brass, silver, &c. and variously divided, according to the purposes it is intended to serve; whence it acquires various denominations, as the plain scale, diagonal scale, plotting scale. See GEOMETRY.

SCALE, in music, is a denomination given to the arrangement of the six syllables invented by Guido Aretine, *ut, re, mi, fa, sol, la*, called also gammut. See MUSIC.

SCALENE, or SCALENOUS TRIANGLE, *scalenum*, in geometry, a triangle whose sides and angles are unequal. See GEOMETRY.

SCALENUS, in anatomy. See ANATOMY, p. 214.

SCALPEL, in surgery, a kind of knife used in anatomical dissections and operations in surgery.

SCALPER, or SCALPING-IRON, a surgeon's instrument used for scraping foul carious bones.

SCALPRADENTALIA, instruments used by the surgeons to take off those black, livid, or yellow crusts, which infect the teeth, and not only loosen and destroy them, but taint the breath.

SCAMMONY, a concreted vegetable juice of a species of convolvulus, partly of the resin, and partly of the gum-kind.

The Aleppo scammony is of a spongy texture, light and friable: it is of a faint disagreeable smell, and its taste is bitterish, very nauseous, and acrimonious. The Symrna scammony is considerably hard and heavy, of a black colour, of a much stronger smell and taste than the former, otherwise it much resembles it.

Scammony is in great esteem and frequent use. It is an ingredient in many compositions of the shops; and these are prescribed, with other cathartics, for purging off ferous humours. It is in general, however, a better purge for robust people than for those of more delicate constitutions; though, with the correctives with which it is joined, it is given with safety and success to children.

SCANDALUM MAGNATUM, in law, is a defamatory speech or writing to the injury of a person of dignity; for which a writ that bears the same name is granted for the recovery of damages.

SCANDEROON, a port-town of Aleppo, in Asiatic Turkey, situated on the coast of the Lesser Asia: E. long. 36°, N. lat. 37° 15'.

SCANDINAVIA, a large country which consisted of Sweden, Denmark, and Norway, which were sometimes under the government of one prince; but is now under the dominion of Sweden and Denmark.

SCANDIX, in botany, a genus of the pentandria digynia class. The corolla is of an irregular shape; the fruit is subulated; the petals are entire; and the stamules of the

disc are generally males. There are eight species, two of them natives of Britain, *viz.* the pecken, shepherds needle, or venus's comb; and the onthriscus, or small hemlock therrill.

SCANNING, in poetry, the measuring of a verse by feet, in order to see whether or no the quantities be duly observed.

The term is chiefly used in regard to the Greek and Latin verses. Thus an hexameter verse is scanned, by resolving it into six feet; a pentameter, by resolving it into five feet, &c.

SCAPE-GOAT, in Jewish antiquity, the goat which was set at liberty on the great day of expiation.

Spencer is of opinion, that the scape-goat was called Azazel, because it was sent to Azazel, *i. e.* the devil; the reasons of which ceremony, he takes to be these: 1. That the goat, loaded with the sins of the people, and sent to Azazel, might denote the miserable condition of the sinners. 2. The goat was sent thus loaded to the dæmons, to shew that they were impure, and to deter the people from worshipping them. 3. That the goat sent to Azazel sufficiently expiating the sins of the Israelites, they might the more willingly abstain from the expiatory sacrifices of the heathens.

SCAPHOIDES, or os naviculare. See ANATOMY, p. 186.

SCAPULA, in anatomy. See ANATOMY, p. 176.

SCAPULAR, in anatomy, a name given to two pair of arteries and as many veins. See ANATOMY, Part III. and IV.

SCAPULAR, or SCAPULARY, a part of the habit of several religious orders in the church of Rome, worn over the gown, as a badge of peculiar veneration for the blessed Virgin. It consists of two narrow breadths or slips of cloth, covering the back and the breast, and hanging down to the feet.

The devotees of the scapulary celebrate its festival on the 16th of July.

SCARABÆUS, the BEETLE, in zoology, a genus of insects, of the coleoptera order: the antennæ of the beetles are of a clavated figure, and fissile longitudinally, and their legs are frequently dentated. There are 87 species.

SCARBOROUGH, a borough and port town of Yorkshire, thirty-seven miles north-east of York.

It sends two members to parliament, and is famous for a medicinal spring, which has been the subject of great contests and disputes among the physical people; all allowing it considerable virtues, but some attributing them to one ingredient, others to another.

SCARIFICATION, in surgery, the operation of making several incisions in the skin by means of lancets, or other instruments, particularly the cupping instrument. See SURGERY.

SCARLET, a beautiful bright red colour.

In painting in water-colours, minium mixed with a little vermilion produces a good scarlet: but if a flower in a print is to be painted of a scarlet-colour, the lights as well as the shades should be covered with minium, and the shaded parts finished with carmine, which will produce an admirable scarlet.

SCARP, in fortification, is the the interior talus, or slope of the ditch next the place, at the foot of the rampart.

SCARP, in heraldry, the scarf which military commanders wear for ornament.

- It is borne somewhat like a battoon finifter, but is broader than it, and is continued out to the edges of the field: whereas the battoon is cut off at each end. See Plate CXLVII. fig. 16.
- SCARPANTO**, an island in the Mediterranean, twenty miles south-west of Rhodes: E. long. 27°, N. lat. 36°.
- SCARUS**, in ichthyology. See **LABRUS**.
- SCAVENGERS**, two officers annually chosen in every parish in London and its suburbs by the church-wardens, constables, and other inhabitants, to hire persons called rakers, with carts, to clean the streets, and carry away the dirt and filth, with the ashes and dust from every house.
- SCENE**, in its primary sense, denoted a theatre, or the place where dramatic pieces and other public shews were exhibited: for it does not appear that the ancient poets were at all acquainted with the modern way of changing the scenes in the different parts of the play, in order to raise the idea of the persons represented by the actors being in different places.
- The original scene for acting of plays was as simple as the representations themselves: it consisted only of a plain plot of ground proper for the occasion, which was in some degree shaded by the neighbouring trees, whose branches were made to meet together, and their vacancies supplied with boards, sticks, and the like; and to complete the shelter, these were sometimes covered with skins, and sometimes with only the branches of other trees newly cut down, and full of leaves. Afterwards more artificial scenes or scenical representations were introduced, and paintings used instead of the objects themselves. Scenes were then of three sorts; tragic, comic, and satyric. The tragic scene represented stately magnificent edifices, with decorations of pillars, statues, and other things suitable to the palaces of kings: the comic exhibited private houses with balconies and windows, in imitation of common buildings: and the satyric was the representation of groves, mountains, dens, and other appearances; and these decorations either turned on pivots, or slid along grooves, as those in our theatres.
- Scene is also a part or division of a dramatic poem. Thus plays are divided into acts, and acts are again subdivided into scenes; in which sense the scene is properly the persons present at, or concerned in, the action on the stage at such a time: whenever, therefore, a new actor appears, or an old one disappears, the action is changed into other hands; and therefore a new scene then commences.
- SCENIC GAMES**, among the ancients, were entertainments exhibited on the scena or theatre, including plays, dancing, and other theatrical performances.
- SCENOGRAPHY**, in perspective, the representation of a body on a perspective plane; or, a description thereof in all its dimensions, such as it appears to the eye. See **PERSPECTIVE**.
- SCEPTER**, a kind of royal staff, or battoon, borne by kings on solemn occasions, as an ensign of command and authority.
- SCEPTICISM**, the doctrines and opinions of the sceptics, whose distinguishing tenet was that all things are uncertain and incomprehensible, and that the mind is never to assent to any thing, but to remain in perpetual doubt and suspense. This doctrine was also called pyrrhonism, from the name of its author. See **PYRRHONIANS**.
- SCHAFFHOUSE**, the capital of the canton of Schaffhouse, one of the most northern cantons of Switzerland: E. long. 8° 40', N. lat. 47° 42'.
- SCHALHOLT**, the capital of Iceland, subject to Denmark: W. long. 19°, N. lat. 64° 30'.
- SCHAMACHIA**, a city of Persia, in the province of Chirvan, situated on the west side of the Caspian sea, in E. long. 50°, N. lat. 41°.
- SCHELD**, a river which rises in the confines of Picardy, and runs north-east by Cambray, Valenciennes, Tournay, Oudenarde, &c. and receiving the Lis at Ghent, runs east by Dendermond, and then north to Antwerp; below which city it divides into two branches; one called the Waeter-Scheld, which separates Flanders from Zeeland, and discharges itself into the sea near Flushing; and the other called the Oister-scheld, which runs by Bergen-op-zoom, and afterwards between the islands Beveland and Schowen, and a little below falls into the sea.
- SHELLING**, an island of Holland, at the entrance of the Zuyder sea, between Flie Island and Ameland: E. long. 5° 20', N. lat. 53° 34'.
- SCHEMNITZ**, capital of the mine towns in Upper Hungary, sixty miles north-east of Presburg.
- SCHENECTIDA**, a fortress of New-York, in America, situated on Hudson's River, in the province of Albany, a hundred miles north of New York city.
- SCHETLAND**, about forty islands, which constitute part of the country of Orkney, or the Orcaades, in Scotland, valuable on account of the herring-fishery on their shores: situated between 1° east and 2° west longitude, and between 61° and 62° of north latitude.
- SCHIRAS**, or **SHERAS**, a city of Persia, in the province of Fars, 180 miles south of Isfahan; reckoned the second city in that kingdom.
- SCHISM**, a separation, or breaking off from communion with any church; on account of some disagreement in matters of faith or discipline.
- SCHOENUS**, in botany, a genus of the triandria monogynia class. The glumæ are paleaceous, and have but one valve; it has no corolla, and but one round seed. The species are 13, five of them natives of Britain.
- SCHOLASTIC**, something belonging to the schools, See **SCHOOL**.
- SCHOLIAST**, a grammarian, who writes scholia, that is, notes, glosses, &c. upon ancient authors, who have written in the learned languages. See the next article.
- SCHOLIUM**, a note, annotation, or remark, occasionally made on some passage, proposition, or the like. This term is much used in geometry, and other parts of mathematics, where, after demonstrating a proposition, it is customary to point out how it might be done some other way, or to give some advice, or precaution, in order to prevent mistakes, or add some particular use, or application thereof.
- SCHOOL**, a public place, wherein the languages, or arts and sciences are taught. Thus we say, grammar-school, writing-school, &c.
- SCHWALBASH**, a town of Germany, in the circle of the Upper Rhine, and in the territory of the Wetteraw, and county of Nassau, eight miles north of Mentz.
- SCHWALBEA**, in botany, a genus of the didynamia angiospermia class. The calix consists of four segments, the

- the superior tube being least, and the lowest largest. There is but one species, a native of America.
- SCHWARTSBURG**, a town of Germany, in the circle of Upper Saxony, and landgrave of Thuringia, eight miles south east of Gotha.
- SCHWARTZENBURG**, a town of Germany, in the circle of Franconia, twenty miles east of Wurtzburg.
- SCHWAFEN**, a town of Germany, in the county of Tyrol, situated on the river Inn, twenty miles north-east of Innspruc.
- SCHWEIDNITZ**, a town of Bohemia, in the duchy of Silesia, capital of a duchy of the same name, situated twenty six miles south of Breslaw.
- SCHWEINFURT**, an imperial city of Germany, in the circle of Franconia, and bishopric of Wurtzburg, situated on the river Maine: in E. long.  $10^{\circ} 15'$ , N. lat.  $50^{\circ} 15'$ .
- SCIENA**, in ichthyology, a genus belonging to the order of thoracici. The membrane of the gills has six rays; the opercula and whole head are scaly. There are five species.
- SCLARRI**, in natural history, the matter which runs down in burning torrents from the craters of volcanos, and which probably contains mineral and metallic particles, it being ponderous and hard.
- Some of the sciarri are coarse, and others fine and polished on the surface; some of them are black, others grey, others reddish, and others of the colour of iron, and many of them have coverings of pure sulphur over their whole surface. They seem to be the result of many sorts of minerals melted together.
- SCIATICA**. See **MEDICINE**, p. 128.
- SCIENCE**, in philosophy, denotes any doctrine, deduced from self-evident and certain principles, by a regular demonstration.
- SCILLA** the **SQUILL**, in botany, a genus of the hexandria monogynia class. The corolla consists of six open, deciduous petals; and the filaments resemble threads. There are eight species, two of them natives of Britain, *viz.* the bifolia, or vernal star-hyacinth; and the autumnalis, or lesser autumnal star-hyacinth.
- The middle part of the root of the scilla maritima, a native of Spain, is only used in medicine: the apothecaries cut the root perpendicularly in two; and separating the heart and the outer parts, they expose the others to dry. This root is extremely acid, attenuant, and dissolvent: it is apt to prove emetic in whatever form it is given; but this may be prevented, by adding a few grains of cinnamon to it: it then becomes a powerful medicine in all obstructions of the viscera; it promotes urine and the menses, and cuts the tough phlegm which almost chokes in asthma and many other disorders of the breast.
- SCILLY**, a cluster of islands and rocks, situated in the Atlantic ocean: W. long.  $7^{\circ}$ , N. lat.  $50^{\circ}$ .
- SCIO**, an island of Turkey, in the Archipelago, situated in E. long.  $27^{\circ}$ , N. lat.  $38^{\circ} 15'$ .
- SCIOPTIC**, a sphere, or globe of wood, with a circular hole or perforation, wherein a lens is placed. It is so fitted, that, like the eye of an animal, it may be turned round every way, to be used in making experiments of the darkened room.
- SCIRO**, an island of Turkey, in the Archipelago, situated E. long.  $25^{\circ}$ , N. lat.  $38^{\circ} 15'$ .
- SCIRPUS**, in botany, a genus of the triandria monogynia class. The glumes are paleaceous, and imbricated; it has no corolla, and ut one beardless seed. The species are 27, ten of which are natives of Britain.
- SCIRRHUS**, in surgery and medicine, a hard tumour of any part of the body, void of pain, arising from the inspissation and induration of the fluids contained in a gland; though it may appear in any other part, especially in the fat, being one of the ways wherein an inflammation terminates. See **MEDICINE** and **SURGERY**.
- SCIURUS** the **SQUIRREL**, a genus of quadrupeds belonging to the order of glires. It has two fore-teeth in each jaw, the superior ones shaped like wedges, and the inferior ones compressed. There are eleven species.
- The vulgaris, or common squirrel, which is a native of most southern parts of Europe, has a pencil of hairs on the top of the ears, four toes on the fore-feet, and five on the hind ones: In the summer, it is of a reddish colour, with a white belly; in the winter, it is of a blueish ash-colour. The squirrel is a very active animal; it feeds upon nuts, berries, &c. which it carries to its mouth by the fore-feet: It lays up its superfluous food in holes; and makes a round nest of moss.
- SCLAREA**, in botany. See **SALVIA**.
- SCLAVONIA**, a province subject to the house of Austria, and bounded on the north-east by the rivers Drave and Danube, which separate it from Hungary; being about two hundred miles long, and sixty broad.
- It takes its name from the Sclavi, an ancient people of European Scythia; from whom is likewise derived the Sclavonic language, which is said to be the most extensive language in the world, except the Arabic; as being the common mother of the Russian, Hungarian, Polish, Bulgarian, Carinthian, Bohemian, &c. languages.
- SCLERANTHUS**, in botany, a genus of the decandria digynia class. The calix consists of one leaf; it has no corolla; and the seeds are two, inclosed in the calix. There are three species, two of them natives of Britain, *viz.* the annuus, german knot-grass, or annual knawel; and the perennis, or perennial knawel.
- SCLEROTICA**, in anatomy. See **ANATOMY**, p. 289.
- SCLEROTICS**, medicines proper to harden and consolidate the flesh of the parts to which they are applied: as purslain, house-leek, fl-a-wort garden night-shade, &c.
- SCOLOPAX**, in ornithology, a genus belonging to the order of grallæ. The beak is cylindrical, obtuse, and longer than the head; the nostrils are linear; the face is covered; and the feet have four toes. There are 18 species.
- SCOLOPENDRA**, in zoology, a genus of insects belonging to the order of aptera. The feet are very numerous, being as many on each side as there are joints in the body; the antennæ are fetaceous; there are two jointed pappi; and the body is depressed. There are eleven species.
- SCOLYMUS**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is paleaceous; the calix is imbricated and prickly; and it has no pappus. There are two species, both natives of Italy.
- SCOMBER**, in ichthyology, a genus belonging to the order of thoracici. The head is smooth and compressed; and there are seven rays in the gill-membrane. The species are ten.

**SCONE**, or **SCOON**, a town of Scotland, near Perth, remarkable for being the place where the kings of Scotland were crowned.

**SCOPARIA**, in botany, a genus of the tetrandria monogynia class. The calix consists of four segments; the corolla is rotated; with four segments; and the capsule has one cell, and two valves, containing many seeds.

There are two species, none of them natives of Britain.

**SCOPER**, or **SCUPER-HOLES**, in a ship, are holes made through the sides, close to the deck, to carry off the water that comes from the pump,

**SCORBUTUS**, the **SCURVY**. See **MEDICINE**, p. 106.

**SCORDIUM**. See **TEUCRIUM**.

**SCORIA**, or **DROSS**, among metallurgists, is the recrements of metals in fusion; or, more determinately speaking, is that mass which is produced by melting metals and ores, and when cold is brittle, and not dissoluble in water; being properly a kind of glass.

**SCORIFICATION**, in metallurgy, is the art of reducing a body, either entirely, or in part, into scoria.

**SCORPÆNA**, in ichthyology, a genus belonging to the order of thoracici. The head is large and sharp; the eyes are near each other; there are teeth in the jaws, palate, and fauces; and there are seven rays in the membrane of the gill. The species are three.

**SCORPIO**, in zoology, a genus of insects belonging to the order of aptera. It has eight feet, besides two frontal claws; the eyes are eight in number, three on each side of the thorax, and two on the back; it has two claw-shaped palpi, a long jointed tail, with a pointed weapon at the extremity; it has likewise two combs situate betwixt the breast and abdomen. There are six species, all natives of southern climates.

**SCORPIO**, in astronomy. See **ASTRONOMY**, p. 487.

**SCORPIURUS**, in botany, a genus of the diadelphia decandria class. The pod is cylindrical, revolute, and intercepted with isلمي. There are four species, none of them natives of Britain.

**SCORZONERA**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; the pappus is plumose; and the calix is imbricated with scales membranaceous at the edges. There are 11 species, none of them natives of Britain.

**SCOT**, a customary contribution laid upon all subjects according to their abilities. Whoever were assessed to any contribution, though not by equal portions, were said to pay scot and lot.

**SCOTIA**, in architecture, a semicircular cavity or channel between the tores, in the bases of columns. See **ARCHITECTURE**.

**SCOTISTS**, a sect of school-divines and philosophers, thus called from their founder J. Duns Scotus, a Scottish cordelier, who maintained the immaculate conception of the virgin, or that he was born without original sin, in opposition to Thomas Aquinas and the Thomists.

**SCOTLAND**, exclusive of the islands, is situated between 1° and 6° W. long. and between 54° 30' and 58° 30' N. lat. being about three hundred miles long from north to south and from fifty to one hundred and fifty miles broad, from east to west.

Since the union with England, Scotland is divided into thirty-three shires, or counties, which all together send only thirty knights to parliament, by reason the shires of

Bute and Cathness chuse only alternately, or every other parliament, in their turns; as do those of Cromarty and Nairn, Clackmannar and Kinross.

The royal boroughs of Scotland are sixty-five, but fo classed as to send only fifteen burgessees to parliament.

**NEW SCOTLAND**, *Nova Scotia*, one of the British colonies in North America, is situated between 62° and 72° W. long. and between 43° and 51° N. lat. being bounded by the river of St Laurence on the north and north-west; by the bay of St Laurence, and the Atlantic Ocean, on the east; by the same ocean, and New-England, on the south; and by Canada, on the west.

**SCOTOMIA**, in medicine, a dizziness or swimming in the head, wherein the animal spirits are so whirled about, that external objects seem to turn round.

**SCRATCH-PANS**, in the English salt-works, a name given to certain leaden pans, which are usually made about a foot and half long, a foot broad, and three incl deep, and have a bow, or circular handle of iron, by which they may be drawn out with a hook, when the liquor in the pan is boiling.

The use of these pans is to receive a calcareous earth, of the nature of that which incrusts our tea kettles, which separates from the water in boiling; this substance they call scratch; and these pans, being placed at the corners of the salt-pan, where the heat is least violent, catch it as it subsides there.

**SCREW**, one of the six mechanical powers. See **MECHANICS**, p. 49.

**SCRIBE**, an officer among the Jews whose business was to write; of which there were three kinds: the first and principal of which were the scribes of the law, whose office was to write and interpret scripture; these were in great credit and esteem among the Jews, and had even the precedency of the priests and sacrificers, and their decisions were received with almost the same respect as the law of God itself: the second kind, properly called scribes of the people, were a sort of magistrates: and the third were public notaries, or secretaries of the council; which were the least considerable.

The scribes, among the Romans, wrote out decrees, or acts, and made out authentic copies of them.

**SCRIBING**, in joinery, &c. is a term used when one side of a piece of stuff is to be fitted to another that is irregular.

**SCRIPTURE**, an appellation given, by way of eminence, to the sacred and inspired writings of the Bible. See **BIBLE**.

**SCROPHULA**, in medicine. See **MEDICINE**, p. 137, &c.

**SCROPHULARIA**, in botany, a genus of the didynamia angiospermia class. The calix has five segments; the corolla is somewhat globular; and the capsule has two cells. There are 14 species, four of them natives of Britain, viz. the nodosa, or knobby-rooted figwort; the aquatica, or water figwort; the scorodonia, or balm-leaved figwort; and the vernalis, or yellow figwort.

**SCROTUM**, in anatomy. See **ANATOMY**, p. 271.

**SCRUPI**, in natural history, fossils, formed into large detached masses without crists, and composed of a variously detached crystalline matter.

**SCRUPLE**, a weight equal to the third part of a dram, or to twenty grains.

SCRU-

SCRUTINY, a strict examination of any thing.

SCULPTURE, an art by which, in taking away, or adding to matter, all sorts of figures are formed by the hand, either in the stone, wood, wax, or metal. In its full latitude it signifies both the art of working in creux, properly called engraving; and of working in relievo, which is more strictly called sculpture.

The first works in sculpture were with clay, not only in making statues, but in forming models; and to this day a sculptor never undertakes any thing considerable, without forming a model, either in clay or wax. In making figures of these materials, they begin and finish their work with their hands, using only three or four pieces of wood, which are roundish at one end, and at the other flat, with a sort of claws and teeth, which are to smooth and scratch the work. For waxen models, to every pound of wax add half a pound colophony some add turpentine, and melt it together with oil of olives; more or less of the latter being used as they would have the matter harder or softer: some also add a little vermilion, to give it a colour: this is wrought and moulded with the fingers like clay.

For sculpture in wood, which we properly call carving, the first thing required is to chuse wood proper for the work the sculptor is to perform. If it be any thing large, and that requires a great deal of strength and solidity, the hardest and most durable wood is to be chosen; and for smaller works and ornaments, the softer wood is used; but it must be such, however, as is firm and close: for a large work, though it be only a single figure, it is better to make use of several pieces of wood, or bits of board, glued together, than of one whole piece, which is more liable to crack; for a thick piece of wood may not be dried to the heart, however it may appear on the outside.

In sculpture in marble and other stone, the first thing to be done is to saw out a block of marble, of the bigness of the work to be performed; and this being done, the superfluities are to be taken off by a stubbed point and a heavy mallet; thus bringing it near the measures required, the sculptor reduces it still nearer with a finer tool, called a dog's tooth, it having two points, but one not so sharp as the other. After this he makes use of his gradine, which is a flat cutting tool, with three teeth: he then takes off, with a smooth chissel, the scratches the gradine left on the marble, and uses it with dexterity and delicacy, to give softness and tenderness to his figure; till at length, taking rasps of different degrees of fineness, the work is gradually rendered fit for polishing. To polish the work, the sculptor uses pumice stone and smalt; then he goes over it with tripoli; and when he would give it more lustre, rubs it with leather and straw ashes. There are several other tools used by sculptors, adapted to the different parts of the work, and the nature of the stone they make use of. As the models of clay shrink as they grow dry, whenever sculptors undertake a considerable piece of work, they only use the model for making a mould of plaster or stucco, in which is formed a figure of the same matter, which serves them thenceforth for a model, and by which they adjust all their measures and proportions. To proceed the more regularly, on the head of the model they place an immovable circle divided into degrees, with a moveable rule or index, fixed in the centre of the circle, and divided also into e-

qual parts: from the end of the rule hangs a line with a plummet, which serves to take all the points, to be transferred thence to the block of marble, from whose top hangs another plummet, like that of the model. But there are some excellent sculptors, who disapprove of this method; urging, that the smallest motion of the model changes their measures, for which reason they chuse rather to take all their measures with the compasses.

SCUM, properly denotes the impurities which a liquor, by boiling, casts up to the surface.

The term *scum* is also used for what is more properly called the scoria of metals.

SCURVY, in medicine. See MEDICINE, p. 106.

SCURVY GRASS, in botany. See COCHLEARIA.

SCUTELLARIA, in botany, a genus of the didynamia gymnospermia class. The calix is entire on the edge, is shut after the flowering, and operculated. The species are 13, two of them natives of Britain, viz. the galericulata, or hooded willow-herb; and the minor, or lesser hooded willow-herb.

SCUTIFORMES, in anatomy, the same with rotula. See ANATOMY, p. 185.

SCUTIFORMIS CARTILAGO, in anatomy, the same with the thyroid cartilage. See ANATOMY, p. 300.

SCUTTLES, in a ship, square holes cut in the deck, big enough to let in the body of a man, serving to let people down into any room below upon occasion, or from one deck to another.

SCYTHIA. The northern parts of Europe and Asia were anciently so called, which afterwards obtained the name of Tartary.

SEA, is frequently used for that vast tract of water encompassing the whole earth; but is more properly a part or division of these waters, and is better defined a lesser assemblage of water, which lieth before and washeth the coasts of some particular countries from whence it is generally denominated, as the Irish sea, the Mediterranean sea, the Arabian sea, &c.

What proportion the superficies of the sea bears to that of the land is not precisely known, though it is said to be somewhat more than two thirds. As the waters of the earth must necessarily rise to the surface thereof, as being specifically lighter than the earth, it was necessary there should be large cavities therein for receptacles to contain them; otherwise they would have overspread all the superficies of the earth, and so have rendered it utterly uninhabitable for terrestrial animals. For the centre of the earth being the common centre of gravity, and the nature of fluids being such that they equally yield to equal powers, and the power of attraction being every where equal at equal distances from the centre, it follows, that the superficial parts of the water will every where conform themselves to an equidistant situation from the centre, and consequently will form the surface of a sphere so far as they extend. Hence, that the sea seems higher than the earth or land, results from the fallacy of vision, whereby all objects, and the parts of land as well as sea, the farther they are off from us, the higher they appear; the reason of all which is plain from optics: for it is well known, that the denser any medium is through which we behold objects, the greater is the refraction, or the more their images appear above the horizontal level; also the greater quantity of the medium the rays pass through,



quantity, and stop up your cask as usual, till you have occasion to broach it.

For the ebbing and flowing of the sea, see *ASTRONOMY*, p. 473.

**SEAMEN**, such as are reserved to serve the king, or other persons, at sea, who may not depart without license, &c. Seamen fighting, quarrelling, or making any disturbance, may be punished by the commissioners of the navy with fine and imprisonment. Registered seamen are exempted from serving in any parish office, &c. and are allowed bounty-money besides their pay. By the law of merchants, the sea-men of a vessel are accountable to the master or commander, and the master to the owners, and the owners to the merchants, for damage sustained either by negligence or otherwise. Where a seaman is hired for a voyage, and he deserts it before it is ended, he shall lose his wages; and in case a ship be lost by a tempest, or in a storm, the seamen lose their wages, as well as the owners their freight.

**SEAFORD**, a port-town of Sussex, situated on the English channel, seven miles south of Lewes. It sends two members to parliament.

**SEAL**, a punchon, or piece of metal, or other matter, usually either round or oval, whereon are engraven the arms, device, &c. of some prince, state, community, magistrate or private person, often with a legend or subscription, the impression whereof in wax serves to make acts, instruments, &c. authentic.

**SEAL** is also used for the wax or lead, and the impression thereon, affixed to the thing sealed.

**SEAL**, in Scots law. See *LAW*, Tit. xii. 25.

**SEALER**, an officer in chancery appointed by the lord chancellor or keeper of the great seal to seal the writs and instruments there made in his presence.

**SEALING**, in architecture, the fixing a piece of wood or iron in a wall with plaster, mortar, cement, lead, and other solid binding. For staples, hinges and joints, plaster is very proper.

**SEALING-WAX**. See *WAX*.

**SEAM** or *SEME* of corn, is a measure of eight bushels.

**SEAM** of glass, the quantity of 120 pound, or 24 stones, each five pounds weight. The seam of wood is an horse-load.

**SEAR CLOTH**, or *CERE-CLOTH*, in surgery, a form of external remedy somewhat harder than an unguent, yet softer than an emplaster, though it is frequently used both for the one and the other. The sear-cloth is always supposed to have wax in its composition, which distinguishes and even denominates it. In effect, when a liniment or unguent has wax enough in it, it does not differ from a sear-cloth.

**SEASIN**, in a ship, the name of a rope by which the boat rides by the ship's side when in harbour, &c.

**SEASONS**, in cosmography, certain portions or quarters of the year, distinguished by the signs which the earth then enters, or by the meridian altitudes of the sun, consequent on which are different temperatures of the air, different works in tillage, &c. The year is divided into four seasons; spring, summer, autumn, and winter. See *ASTRONOMY*, p. 546.

*St.* **SEBASTIAN**, a port-town of Spain, in the province of Biscay, and territory of Guipuscoa: situated in W. long. 1° 50', N. lat. 43° 35'.

**SECALE, RYE**, in botany, a genus of the triandria digy-

nia class. The involucre consists of two leaves, and contains two flowers. There are four species, only one of them, *viz.* the villosum, or wood rye-grass, a native of Britain. For the cerealia, or common rye cultivated in our fields, see *AGRICULTURE*, p. 61.

**SECANT**, in geometry, is a line that cuts another, or divides it into two parts.

**SECEDERS**, a sect of Presbyterians, who dissented from the established church of Scotland in the year 1733. The following circumstance gave rise to this sect. Mess. Erskine, Wilson, Moncrieff, and Fisher, ministers of the church of Scotland, obstinately refused, for several years, to obey the decisions of the General Assembly with regard to the settlement of ministers agreeably to the law of patronage: For this open contempt of authority, the Assembly, after many and repeated admonitions, were at last obliged to eject them from their respective charges. These four clergymen, when they saw matters carried this length, immediately complained of persecution; professed uncommon sanctity and austerity of manners; and cried out that the church was over-run with various errors, such as, a compliance with the law of patronage; the tenderness of the assembly to Professors Simson and Campbell, who were accused of Arian and Arminian heresies; and a multitude of practical deviations from the covenanted reformation of Scotland: They even inveighed against the conduct of the government for their ready admission of malignant and wicked men into places of trust in the army and state; for the loose and unlimited restoration of Charles II. to the throne; for the restoration of prelacy in England, which had been solemnly abjured; for restoring the superstitious Christmas vacance; for the repeal of the penal laws against *witches*, &c. &c. These things, joined to the popular talents of some of the above ministers, alarmed the minds of many well-meaning people, and in a few years procured a numerous train of followers. Elated with this unexpected success, they soon split into two parties. The chief point of contest among the leaders of this sect was concerning the lawfulness of what is called the burges-oath; and hence the one party have ever since been called *Burghers*, and the other *Antiburghers*. This division naturally weakened their cause, and diminished their number, which still seems to be upon the decline.

**SECOMIÆ**, in natural history, the name of a genus of fossils, of the class of the septaria, the characters of which are; that they are bodies of a dusky hue, divided by septa, or partitions of a sparry matter, into several more or less regular portions, of a moderately firm texture, not giving fire with steel, but fermenting with acid menstrua, and easily calcining.

The septaria of this genus are, of all others, the most common, and are what have been known by the little expressive, or mistaken names of the waxen vein, or ludus helmontii. We have many species of these bodies common among us. Of the whitish or brownish kinds we have thirteen; of the yellowish five; and of the ferruginous ones, four.

**SECOND**, in geometry, chronology, &c. the sixtieth part of a prime or minute, whether of a degree, or of an hour.

**SECOND**, in musick, one of the musical intervals; being only the difference between any sound and the next nearest sound, whether above or below it.

**SECONDARY**, in general, something that acts as second, or in subordination to another.

**SECRETARY**, an officer who by his master's orders writes letters, dispatches, and other instruments, which he renders authentic by his signet. Of these there are several kinds; as, 1. Secretaries of state, who are officers that have under their management and direction the most important affairs of the kingdom, and are obliged constantly to attend on the king: they receive and dispatch whatever comes to their hands, either from the crown, the church, the army, private grants, pardons, dispensations, &c. as likewise petitions to the sovereign; which when read, are returned to them; all which they dispatch according to the king's direction. They have authority to commit persons for treason, and other offences against the state, as conservators of the peace at common law, or as justices of the peace throughout the kingdom. They are members of the privy-council, which is seldom or never held without one of them being present: and as to the business and correspondence in all parts of this kingdom, it is managed by either of the secretaries without any distinction: but with respect to foreign affairs the business is divided into two provinces, or departments, the southern and the northern, comprehending all the kingdoms and states that have any intercourse with Great Britain; each secretary receiving all letters and addresses from, and making all dispatches to, the several princes and states comprehended in his province. Ireland and the Plantations are under the direction of the elder secretary, who has the southern province, which also comprehends France, Italy, Switzerland, Spain, Portugal, and Turkey: the northern province includes the Low Countries, Germany, Denmark, Sweden, Poland, and Muscovy. Each of the secretaries have an apartment in all the royal houses, both for their own accommodation and their officers; they have also a table at the king's charge, or else board-wages. The two secretaries of state have each two under secretaries, and one chief clerk, with an uncertain number of other clerks and translators, all wholly depending on them. To the secretaries of state belong the custody of that seal properly called the signet, and the direction of two other offices, one called the paper-office, and the other the signet-office.

2. Secretary of an embassy, a person attending an ambassador for writing dispatches relating to the negotiation. There is a great difference between the secretary of an embassy, and the ambassador's secretary; the last being a domestic or menial of the ambassador, and the first a servant or minister of the prince. 3. The secretary of war, an officer of the war-office, who has two chief clerks under him, the last of which is the secretary's messenger. There are also secretaries in most of the other offices.

**SECRETION**, the separation of some fluid from the blood by means of the glands.

In the bodies of animals we observe a great number of juices of different natures, viz the blood, lymph, saliva, stomach liquor, intestinal juices, pancreatic juice, bile, urine, &c. and the blood is the general source of all. See BLOOD, LYMPH, SALIVA, &c.

**SECT**, a collective term, comprehending all such as follow the doctrines and opinions of some famous divine, philosopher, &c.

**SECTION** in general, denotes a part of a divided thing,

or the division itself. Such, particularly, are the subdivisions of a chapter; called also paragraphs and articles: the mark of a section is §.

**SECTION**, in geometry, denotes a side or surface appearing of a body or figure cut by another; or the place where lines, planes, &c. cut each other.

**SECTOR**, in geometry, is a part of a circle comprehended between two radii and the arch; or it is a mixed triangle, formed by two radii and the arch of a circle.

**SECTOR** is also a mathematical instrument, of great use in finding the proportion between quantities of the same kind, as between lines and lines, surfaces and surfaces, &c. for which reason the French call it the compass of proportion.

The great advantage of the sector above common scale, &c. is, that it is adapted to all radii, and all scales. For, by the line of chords, sines, tangents, &c. on the sector, we have lines of chords, sines, tangents, &c. adapted to any radius betwixt the length and breadth of the sector, when opened.

The sector is founded on the fourth proposition of the sixth book of Euclid, where it is demonstrated, that similar triangles have their homologous sides proportional.

**SECULAR**, something that is temporal; in which sense, the word stands opposed to ecclesiastical: thus we say, secular power, secular jurisdiction, &c.

**SECULAR GAMES**, *ludi seculares*, in antiquity, solemn games held among the Romans once in an age. These games lasted three days and as many nights, during which time sacrifices were performed, theatrical shews exhibited, with combats, sports, &c. in the circus. The occasion of these games, according to Valerius Maximus, was to stop the progress of a plague. The first who had them celebrated at Rome was Valerius Publicola, the first consul created after the expulsion of the kings. The ceremonies to be observed therein were found prescribed in one of the books of the Sibyls. At the time of the celebration of the secular games, heralds were sent throughout all the empire, to intimate that every one might come and see those solemnities which he never yet had seen, nor was ever to see again. Authors are not agreed as to the number of years wherein these games returned, partly because the quantity of an age or seculum among the ancients is not known, and partly on other accounts; some will have it that they were held every hundred years, and that the seculum or age was our century.

**SECULARIZATION**, the act of converting a regular person, place, or benefice, into a secular one.

**SECUNDINES**, in anatomy, the several coats or membranes wherein the fetus is wrapped up in the mother's womb, as the chorion and amnios, with the placenta, &c. See MIDWIFERY.

**SECURIDACA**, in botany, a genus of the diadelphia decandria class. The calix consists of three leaves; the corolla is papilionaceous, with a vexillum; and the pod is oval, and contains one seed. There are two species, both natives of America.

**SECUTORES**, in antiquity, a kind of gladiators among the Romans, who fought against the retiarii. The secutores were armed with a sword and a buckler, to keep off the net or noose of their antagonists, and they wore a case on their head.

This was also a name given to such gladiators as took the place of those killed in the combat, or who fought the conqueror.

**SEDAN**, a town of Champagne, in France, situated on the river Maas: in E. long.  $4^{\circ} 45'$ , N. lat.  $49^{\circ} 46'$ .

*Ad vs* **SEDERUNT**, in Scots law. See **LAW**, Tit. i. 4.

**SEDIMENT**, the settlement or dregs of any thing, or that gross heavy part of a fluid body which, upon resting, sinks to the bottom of the vessel.

**SEDITION**, in Scots law. See **LAW**, Tit. xxxiii. 13.

**SEDR**, or **SEORE**, the high priest of the sect of Ali among the Persians. The sedr is appointed by the emperor of Persia, who usually confers the dignity on his nearest relation. The jurisdiction of the sedr extends over all effects destined for pious purposes, over all mosques, hospitals, colleges, sepulchres, and monasteries. He disposes of all ecclesiastical employments, and nominates all the superiors of religious houses. His decisions in matters of religion are received as so many infallible oracles; he judges of all criminal matters in his own house without appeal. His authority is balanced by that of the mudshahid, or first theologue of the empire.

**SEDUM**, in botany, a genus of the decandria pentagynia class. The calix consists of five segments, and the corolla of five petals; it has five nectariferous scales at the base of the germen, and five capsules. There are 19 species, nine of them natives of Britain, all orpines and house-leeks.

**SEED**, in physiology, a substance prepared by nature for the reproduction and conservation of the species both in animals and plants. See **GENERATION**, and **AGRICULTURE**, p. 40.

**SEEDLINGS**, among gardeners, denote such roots of gilliflowers, &c. as come from seed sown. Also the young tender shoots of any plants that are newly sown.

**SEEDY**, in the brandy trade, a term used by the dealers, to denote a fault that is found in several parcels of French brandy, which renders them unfaleable. The French suppose that these brandies obtain the flavour which they express by this name from weeds that grow among the vines from whence the wine of which this brandy is made was pressed.

**SEEING**, the act of perceiving objects by the organ of sight; or it is the sense we have of external objects by means of the eye. See **OPTICS**.

**SEELING**, in the manege. A horse is said to feel when he begins to have white eye brows; that is, when there grows on that part about the breadth of a farthing of white hairs, mixed with those of his natural colour, which is a mark of old age. It is said, that a horse never feels till he is fourteen years old, and always does before he is sixteen years.

**SEELING**, at sea, is used in the same sense nearly with heeling: when a ship lies down constantly, or steadily on one side, the seamen say she heels; and they call it feeling when she tumbles violently and suddenly, by reason of the sea forsaking her, as they call it, that is, the waves leaving her for a time in a bowling sea.

**SEGEDIN**, a city of Upper Hungary, situated on the river Teyffe, in E. long.  $21^{\circ}$ , N. lat.  $46^{\circ} 21'$ .

**SEGESWAAE**, a city of Transylvania, situated E. lon.  $24^{\circ}$ , N. lat.  $47^{\circ} 25'$ .

**SEGMENT** of a circle, in geometry, that part of the circle contained between a chord and an arch of the same circle.

**SEGOVIA**, a city of Manila, the largest of the Philippine islands, situated in E. long.  $119^{\circ}$ , N. lat.  $18^{\circ} 30'$ .

This is also a name of a city of Spain, in the province of Old Castile, situated W. long.  $4^{\circ} 35'$ , N. lat.  $41^{\circ}$ .

**SEGRA**, a river of Spain, which rising in the north of Catalonia, and running south west, discharges itself into the Ebro, at Miquineua.

**SEGREANT**, is the herald's word for a griffon, when drawn in a leaping posture, and displaying his wings as if ready to fly.

**SEGUE**, in the Italian musick, is often found before *aria*, *alleluja*, *amen*, &c. to shew that those portions or parts are to be sung immediately after the last note of that part over which it is writ; but if these words *si piace*, or *ad libitum*, are joined therewith, it signifies, that these portions may be sung or not, at pleasure.

**SEGURA**, a town of Portugal, in the province of Beira, ten miles north-west of Alcantara. This is also the name of a town in Spain, in the province of New Castile, and territory of La Mancha, situated among the mountains of Segura; W. long.  $2^{\circ} 50'$ , N. lat.  $38^{\circ} 25'$ .

**SEJANT**, a term used in heraldry, when a lion, or other beast, is drawn, in an escutcheon, sitting like a cat, with his fore feet frait.

**SEIZURE**, in commerce, an arrest of some merchandize, moveable, or other matter, either in consequence of some law, or of some express order of the sovereign.

**SEISIN**, in Scots law. See **LAW**, Tit. x. 16.

**SELAGO**, in botany, a genus of the didynamia angiospermia class of plants. The calix has five segments; the tube of the corolla is capillary; and there is but one seed. The species are eight, none of them natives of Britain.

**SELBY**, a town of Yorkshire, situated ten miles south of York.

**SELENDERS**, in the manege, are chops, or mangy fores, in the bending of a horse's hough, as the malenders are in the knees. See **FARRIERY**.

**SELENITÆ**, MOON STONE, in natural history, a class of fossils, naturally and essentially simple; not inflammable nor soluble in water; composed of slender filaments, ranged into fine and even thin flakes, and those disposed into regular figures, in the different genera, approaching to a rhomboide, a hexangular column, or a rectangled inequilateral parallelogram; fissile like the talcs, but that not only horizontally, but perpendicularly also; flexile in a small degree, but not at all elastic; not fermenting with acid menstrua, and readily calcining in the fire.

**SELENOGRAPHY**, a branch of cosmography, which describes the moon and all the parts and appearances thereof, as geography does those of the earth.

**SELEUCIDÆ**, in chronology. Æra of the Seleucidæ, or the Syro-macedonian æra, is a computation of time commencing from the establishment of the Seleucidæ, a race of Greek kings, who reigned as successors of Alexander the Great in Syria, as the Ptolemies did in Egypt. This æra we find express'd in the book of the Maccabees, and on a great number of Greek medals struck by the cities of Syria, &c. The Rabbins call it the æra of contracts; and the Arabs, Therik dilkarnain, that is, the æra of the two horns. According to the best accounts, the first

- year of this æra falls in the year 311 before Christ, being twelve years after Alexander's death.
- SELINGENSKOY**, a town of Asiatic Muscovy, in the province of Siberia, situated on the road from Tobolski to China, on the river Selinga: in E. long. 65°, N. lat. 50°.
- SELINUM**, in botany, a genus of the pentandria digynia class. The fruit is somewhat oval, and striated in the middle; the involucrium is reflected; and the petals are equal and cordate. There are four species, none of them natives of Britain.
- SELKIRK**, a borough town of Scotland, in the county of Tweedale, situated 32 miles south of Edinburgh.
- SELLA TURCICA**. See **ANATOMY**, p. 149.
- SELTZER WATER**, the name of a mineral water of Germany, which arises near Neider Seltz, and is now used in England and many other countries. We call it feltz, or saltz water; and the physicians prescribe it in many cases, as scurvy, spasmodic affections, and in consumptions; in the last case, mixing it with asses milk.
- SEMIOTICA**, that part of medicine which considers the signs or indications of health and diseases, and enables the physician to judge what is, was, or will be, the state, degree, order, and effect, of health or sickness.
- SEMENDRIA**, a town of European Turkey, in the province of Servia, situated on the Danube, thirty miles south-east of Belgrade.
- SEMENTINEÆ FERIÆ**, in antiquity, feasts held annually among the Romans, to obtain of the gods a plentiful harvest. They were celebrated in the temple of Tellus, where solemn sacrifices were offered to Tellus and Ceres. These feasts were held about seed-time, usually in the month of January; for Macrobius observes, they were moveable feasts.
- SEMI**, a word borrowed from the Latin, signifying *half*, but only used in composition with other words, as in the following articles.
- SEMI-CIRCLE**, in geometry, half a circle, or that figure comprehended between the diameter of a circle and half the circumference.
- SEMI-COLON**, in grammar, one of the points or stops used to distinguish the several members of sentences from each other. See **PUNCTUATION**.
- The mark or character of the semi-colon is (;) and has its name as being somewhat of less effect than a colon, or as demanding a shorter pause.
- SEMI-CUPIUM**, in medicine, an half bath, wherein the patient is only placed up to the navel.
- SEMI-DIAMETER**, half the diameter, or a right line drawn from the centre of a circle, or sphere, to its circumference; being the same with what is otherwise called the radius.
- SEMI-FLOSCULUS**, in botany, a term used to express the flowers of the syngenesia class. These semiflosculus are petals, hollow in their lower part, but in their upper flat, and continued in the shape of a tongue.
- SEMIGALIA**, the eastern division of the duchy of Courland in Poland.
- SEMI-INTEROSSEUS INDICIS**, in anatomy. See **ANATOMY**, p. 201.
- SEMI LUNAR VALVES**, in anatomy. See **ANATOMY**, p. 178.
- SEMI-MEMBRANOSUS**, in anatomy. See **ANATOMY**, p. 208.
- SEMI-PELAGIANS**, in church-history, a branch of the Pelagians, so called because they pretended to keep a medium between the Pelagians and the orthodox.
- SEMI-TONE**, in musick, one of the degrees or concinnous intervals of concords.
- SEMINAL**, something belonging to the semen or seed.
- SEMINARY**, a kind of college, or school, where youth are instructed in the ceremonies, &c. of the sacred ministry, of which there are many abroad; it being ordained by the council of Trent, that there be a seminary belonging to each cathedral, under the direction of the bishop.
- SEMINATION**, denotes the manner, or act, of shedding and dispersing the seeds of plants. See **AGRICULTURE**, p. 59.
- SEMI-NERVOSUS**, in anatomy. See **ANATOMY**, p. 208.
- SEMIS**, in Roman antiquity, the half of an *as*. See **AS**.
- SEMI-SPINALIS**, in anatomy. See **ANATOMY**, p. 218.
- SEMPERVIVUM**, in botany, a genus of the dodecandria dodecagynia class. The calix consists of twelve segments; and the corolla of twelve petals; and there are twelve capsules containing many seeds.
- SENA**, in botany. See **CASSIA**.
- Sena leaves are much used for their purgative virtue; but are apt to gripe, unless given with proper correctives, as coriander, aniseed, ginger, raisins, and salt of tartar, which are added to the infusion of the leaves occasionally.
- SENATE**, in general, is an assembly, or council, of senators; that is, of the principal inhabitants of a state, who have a share in the government.
- The senate of ancient Rome is, of all others, the most celebrated: it exercised no contentious jurisdiction, but appointed judges, either from among the senators or knights, to determine processes: it also appointed governors of provinces, and disposed of the revenues of the commonwealth, &c. Yet did not the whole sovereign power reside in the senate; since it could not elect magistrates, make laws, or decide of war or peace; in all which cases the senate was obliged to consult the people.
- According to Dr Middleton, the constant and regular supply of the senate was from the annual magistrates; who, by virtue of their several offices, acquired a right to sit and vote in that assembly: the usual gradation of these offices being that of *quæstor*, tribune of the people, *ædile*, *prætor*, and *consul*.
- The senate always met of course on the first of January, for the inauguration of the new consuls; and in all months universally, there were three days, *viz.* the kalends, nones, and ides, on which it regularly met: but it always met on extraordinary occasions, when called together by consul, tribune, or dictator.
- SENATOR**, in general, denotes a member of some senate.
- SENATUS AUCTORITAS**, a vote of the Roman senate, drawn up in the same form with a decree, but without its force, as having been hindered from passing into a decree by some of the tribunes of the people.
- SENATUS CONSULTUM** a decree of the Roman senate, pronounced on some question or point of law; which, when passed, made a part of the Roman law.
- SENECIO**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is naked; the pappus is simple; and the calix is cylindrical, and calcified. There are 40 species, eight of them natives of Britain.
- SENEGA**, or **SENEGAL**, a river of Negroland, in Africa, which

which falls into the Atlantic ocean, in 16° N. lat. whence the gum-senega is imported.

**SENECHAL**, a term anciently used for steward or majordomo.

**SENS**, a town of Champagne, in France, situated on the river Yonne, sixty miles south-east of Paris.

**SENSATION**, in philosophy, the art of perceiving external objects, by means of the senses.

**SENSE**, a faculty of the soul, whereby it perceives external objects, by means of the impressions they make on certain organs of the body. These organs of sensation are commonly reckoned five, *viz.* the eye, whereby we see objects; the ear, which enables us to hear sounds; the nose, by which we receive the ideas of different smells; the palate, by which we judge of tastes; and the cutis, or skin, which enables us to feel the different forms, hardness, or softness of bodies. See **ANATOMY**, p. 289, 293, 295, 303; **OPTICS**, *passim*; and **PNEUMATICS**.

**SENSITIVE PLANT**, in botany. See **MIMOSA**.

**SENSORIUM COMMUNE**, the same with the brain. See **ANATOMY**, p. 285.

**SENTENCE**, in Scots law. See **LAW**, Tit. xxxii. 1, &c.

**SENTENCE**, in grammar, a period or set of words, comprehending some perfect sense or sentiment of the mind.

**SENTIMENTS**, properly signifies the feelings excited in our minds by means of the senses.

**SENTINEL**, in military affairs, is a private soldier, placed in some post, to watch any approach of the enemy, to prevent surprisings, and to stop such as would pass without order, or discovering who they are.

**SEPARATION of Husband and Wife**, in Scots law. See **LAW**, Tit. vi. 13.

**SEPARATISTS**, an appellation given to dissenters, from their setting up a separate church from the established one.

**SEPIA**, in zoology, a genus belonging to the order of vermes mollusca. There are eight brachia interspersed on the interior side, with little, round, serrated cups, by the contraction of which the animal lays fast hold of any thing: Besides these eight arms, it has two tentacula longer than the arms, and frequently pelunulated. The mouth is situate in the centre of the arms; and is horny and hooked, like the bill of a hawk. The eyes are below the tentacula, towards the body of the animal. The body is fleshy, and received into a sheath as far as the breast. There are five species. The officinalis, or cuttlefish, emits a black matter when attacked, which hides it from the view of the enemy. The *holigo*, has a subelated cylindrical body, with a rhomboidal tail. It is sometimes found on the coasts of the frith of Forth, especially after great storms. The other species are mostly found in the Mediterranean sea.

**SEPS**, in zoology. See **LACERTA**.

**SEPTARIÆ**, in natural history, a large class of fossils, commonly known by the names of *ludus Helmontii* and *waxen veins*.

They are defined to be fossils not inflammable, nor soluble in water; of a moderately firm texture, and dusky hue, divided by several septa or thin partitions, and composed of a sparry matter greatly debased by earth, not giving fire with steel, fermenting with acids, and in great part dissolved by them, and calcining in a moderate fire.

Of this class there are two distinct orders of bodies; and under those, six genera. The septariæ of the first order are those which are usually found in large masses, of a simple uniform construction, but divided by large septa either into larger and more irregular portions, or into smaller and more equal ones, called talc. The genera of this order are four: 1. Those divided by septa of spar, called *secumæ*. 2. Those divided by septa of earthy matter, called *gatiophragmia*. 3. Those divided by septa of the matter of the pyrites, called *pyritercia*. And, 4. Those divided by septa of spar, with an admixture of crystal, called *diagophragmia*.

Those of the second order are such as are usually found in smaller masses, of a crustated structure, formed by various incrustations round a central nucleus, and divided by very thin septa. Of this order are only two genera: 1. Those with a short roundish nucleus, inclosed within the body of the mass; And, 2. Those with a long nucleus, standing out beyond the ends of the mass.

**SEPTEMBER**, the ninth month of the year, consisting of only thirty days: it took its name as being the seventh month, reckoning from March, with which the Romans began their year.

**SEPTENTRIO**, in astronomy, a constellation more usually called *ursa minor*.

In cosmography, the term *septentrio* denotes the same with north: and hence, *septentrional* is applied to any thing belonging to the north, as *septentrional signs*, *parallels*, &c.

**SEPTIZON**, in Roman antiquity, a celebrated mausoleum, built by Septimus Severus, in the tenth region of the city of Rome: it was so called from *septem* and *zona*, by reason it consisted of seven stories, each of which was surrounded by a row of columns.

**SEPTUAGESIMA**, in the calendar, denotes the third Sunday before Lent, or before quadragesima Sunday; supposed by some to take its name from its being about seventy days before Easter.

**SEPTUAGINT**, the name given to a Greek version of the books of the Old Testament. See **BIBLE**.

**SEPTUM**, in anatomy, an inclosure, or partition, a term applied to several parts of the body which serve to separate one part from another.

**SEPULCHRE**, a tomb, or place destined for the interment of the dead. This term is chiefly used in speaking of the burying places of the ancients, those of the moderns being usually called *tombs*.

Sepulchres were held sacred and inviolable, and the care taken of them has always been held a religious duty, grounded on the fear of God, and the belief of the soul's immortality. Those who have searched or violated them have been thought odious by all nations, and were always severely punished.

The Egyptians called sepulchres, *eternal houses*; in contradistinction to their ordinary houses or palaces which they called *inns*, on account of their short stay in the one, in comparison of their long abode in the other.

*Regular canons of St SEPULCHRE*, a religious order, formerly instituted at Jerusalem, in honour to the holy sepulchre, or the tomb of Jesus Christ.

Many of these canons were brought from the Holy Land into Europe, particularly into France by Lewis the younger; into Poland, by Jaxa a Polish gentleman; and into

into Flanders, by the counts thereof; many also came into England. This order was however suppressed by pope Innocent VIII who gave its revenues and effects to that of our Lady of Bethlehem; which also becoming extinct, they were bestowed on the knights of St John of Jerusalem. But the suppression did not take effect in Poland, where they still subsist, as also in several provinces of Germany. These canons follow the rule of St. Augustine.

*Knights of the holy SEPULCHRE*, a military order, established in Palestine about the year 1114.

The knights of this order in Flanders chose Philip II. king of Spain, for their master in 1558, and afterwards his son; but the grand master of the order of Malta prevailed on the last to resign: and when afterwards the duke of Nevers assumed the same quality in France, the same grand master, by his interest and credit, procured a like renunciation of him, and a confirmation of the union of this order to that of Malta.

*SEQUELS*, in Scots law. See *LAW*, Tit. xvi. 12.

*SEQUESTRATION*, in Scots law. See *LAW*, Tit. xix. 10 and xx. 12.

*SEQUIN*, a gold-coin, struck at Venice, and in several parts of the grand seignor's dominions.

*SERAGLIO*. A Persian word, which signifies the palace of a prince or lord; in which sense the houses of the ambassadors of England, France, &c. are, at Constantinople, called their seraglios. But the term seraglio is used, by way of eminence, for the palace of the grand seignor at Constantinople, where he keeps his court, in which his concubines are lodged, and where the youth are trained up for the principal posts of the empire. It is in form of a triangle, about two miles round, at the end of the promontory Chrysoceas, now called the Seraglio-point: the buildings extend to the top of the hill, and from thence there are gardens that reach to the sea. The outward appearance is not very beautiful, the architecture being irregular, consisting of separate edifices, in the manner of pavilions and domes. The old seraglio is the palace where the grand seignor's old mistresses are kept.

The ladies of the haram, which is the part allotted to the women, is a collection of young beautiful girls, who, on their admission, are committed to the charge of some old lady, and taught musick, dancing, and other accomplishments. These frequently play and dance before the grand seignor, while others entertain him with their conversation. Besides these ladies, there are a great many black eunuchs, and female slaves, in the seraglio, whose business it is to guard and wait upon them.

*SERAPH*, or *SERAPHIM*, a spirit of the highest rank in the hierarchy of angels; who are thus called from their being supposed to be most inflamed with divine love, by their nearer and more immediate attendance at the throne of God, and to communicate their fervour to the remoter and inferior orders.

*SERAPHIC*, burning or inflamed with love or zeal, like a seraphim: thus St. Bonaventure is called the seraphic doctor, from his abundant zeal and fervour.

*SERAPIAS* in botany, a genus of the gynandria diandria class. The nectarium is oval and gibbous, with an oval lip. There are five species, two of them natives of Britain, viz. the latifolia, or broad-leaved bastard hellebore; and the lingifolia, or white-flowered bastard hellebore.

*SERENADE*, a kind of concert given in the night, by a lover to his mistress, under her window. These sometimes only consist of instrumental musick, but at other times voices are added: the musick and song composed for these occasions are also called serenades.

*SERENE*, a title of honour given to several princes, and to the principal magistrates of republics. The king of England, the republic and the doge of Venice, and the children of the king of Spain, are called Most Serene: and when the pope, or the sacred college, write to the emperor, to kings, or the doge, they give them no other title: in like manner the emperor gives no other title to any king, except to the king of France.

*SERGE*, a woolen stuff manufactured in a loom, of which there are various kinds, denominated either from their different qualities, or from the places where they are wrought; the most considerable of which is the London serge, which is highly valued abroad, and of which a manufacture has been for some years carried on in France.

*SERGEANT*, or *SERJEANT at law*, or *of the coif*, is the highest degree taken at the common law, as that of doctor is of the civil law; and as these are supposed to be most learned and experienced in the practice of the courts, there is one court appointed for them to plead in by themselves, which is the common-pleas, where the common law of England is most strictly observed; but they are not restrained from pleading in any other court, where the judges, who cannot have that honour till they have taken the degree of serjeant at law, call them brothers.

*SERGEANT at arms*, or *mace*, an officer appointed to attend the person of the king; to arrest traitors, and such persons of quality as offend; and to attend the lord high steward when sitting in judgment on a traitor.

The number of these officers is by statute limited to that of thirty.

*SERGEANT*, in war, is an inferior officer in a company of foot, or troop of dragoons, armed with an halbard, and appointed to see discipline observed, to teach the soldiers the exercise of their arms, and to order, straiten, and form ranks, files, &c.

*SERICUM*. See *SILK*.

*SERIES*, in general, denotes a continued succession of things in the same order, and having the same relation or connection with each other: in this sense we say, a series of emperors, kings, bishops, &c.

*SERIES*, in mathematicks, is a number of terms, whether of numbers or quantities, increasing or decreasing in a given proportion. See *ALGEBRA*, p. 83.

*SERIPHIMUM*, in botany, a genus of the syngenesia monogynia class. The calix is imbricated; the corolla consists of one irregular petal; and there is a single oblong seed below the corolla. There are three species, none of them natives of Britain.

*SEROSITY*, in medicine, denotes an over-abundance of serum.

*SERPA*, a town of Portugal, in the province of Alentejo, situated on the east-side of the river Guadiana, in W. long. 8° 20', N. lat. 37° 45'.

*SERPENS*, in astronomy. See *ASTRONOMY*, p. 487.

*SERPENT*, in zoology. See *COLUBER*, *BOA*, *ANGUIS*, *CECILIA*, *AMPHISBENA*, *CROTALUS*.

*SERPENTARIA*, *SNAKE-ROOT*, the name of a species of aristolochia, or birthwort, with articulated leaves.

- The Virginian snake-root obtained its name, as being accounted a specific against venomous bites: but whatever truth there may be in that, it is undoubtedly an excellent diuretic, diaphoretic, and alexipharmic medicine, and consequently good in inflammatory and malignant fevers: it is also a powerful antiseptic, and its dose is from four to ten or fifteen grains in powder.
- SERPENTARIUS**, in astronomy. See **ASTRONOMY**, p. 487.
- SERPENTINE**, in general, denotes any thing that resembles a serpent: hence, the worm or pipe of a still, twisted in a spiral manner, is termed a serpentine worm.
- SERRATED**, in general, something indented, or notched, in the manner of a saw; a term, much used in the description of the leaves of plants.
- SERRATULA**, in botany, a genus of the syngenesia polygamia æqualis class. The calix is somewhat cylindrical, imbricated, and blunt. There are 16 species three of them natives of Britain, viz. the tinctoria, or saw-wort; the alpina, or mountain saw-wort; and the arvensis, or corn saw-wort.
- SERRATUS**, in anatomy, a name given to several muscles, from their resemblance to a saw. See **ANATOMY**, Part II.
- SERVANT**, a term or relation signifying a person who owes and pays a limited obedience for a certain time, to another in quality of master. See **LAW**, Tit. vii. 34.
- SERVETISTS**, a name given to the modern antitrinitarians, from their being supposed to be the followers of Michael Servetus, who, in the year 1599, was burnt at Geneva, together with his books.
- SERVIA**, a province of European Turkey, bounded by the Save and the Danube, on the north; by Bulgaria, on the east; by Albania and Macedon, on the south; and by Bosnia and Dalmatia, on the west.
- SERVICE OF HEIRS**, in Scots law. See **LAW**, Tit. xxvii. 22, &c.
- SERVITES**, a religious order in the church of Rome, founded about the year 1233, by seven Florentine merchants, who, with the approbation of the bishop of Florence, renounced the world, and lived together in a religious community on mount Senar, two leagues from that city.
- SERVITOR**, in the university of Oxford, a student who attends on another for his maintenance and learning.
- SERVITUDE**, in Scots law. See **LAW**, Tit. xvi. 1, &c.
- SERUM**, a thin, transparent, saltish liquor, which makes a considerable part in the mafs of blood. See **BLOOD**.
- SESAMOIDA Ossa**, in anatomy. See **ANATOMY**, p. 188.
- SESAMUM**, in botany, a genus of the didynamia angiospermia class. The calix consists of five segments; the corolla is campanulated, with five segments; the stigma is lanceolated; and the capsule has four cells. There are two species, both natives of India.
- The seeds of this plant, upon expression, yield a larger quantity of oil than almost any other known vegetable; among the Indians, they are used as food.
- SESELL**, in botany, a genus of the pentandria digynia class. The umbellæ are globular; the involucre consists of many leaves; and the fruit is oval and striated. There are 13 species, only one of them, viz. the caruifolia, or meadow-saxifrage, a native of Britain.
- SESQUI**, a Latin participle, signifying a whole and a half, which joined with *altera*, *terna*, *quarta*, &c. is much used in the Italian musick to express a kind of ratios, particularly several pieces of triples.
- SESSILE**, among botanists. See **BOTANY**, p. 541.
- SESSION**, in general, denotes each sitting or assembly of a council, &c.
- SESSION of parliament**, is the season or space from its meeting to its prorogation.
- Court of SESSION**, in Scots law. See **LAW**, Tit. iii. 4.
- SESTERCE**, a silver coin in use among the Romans.
- Some authors make two kinds of sesterces, the less called sesterlius, in the masculine gender; and the great one, called sestertium, in the neuter; the latter containing a thousand of the other.
- Others will have any such distinction of great and little sesterces unknown to the Romans: Sesterlius, say they, was an adjective, and signified as *sestertius*, or two asses and an half; and when used plurally, as in *quinquaginta sestertium*, *sestertia*, it was only by way of abbreviation, and there was always understood millia, or thousand.
- SESTOS**, a noted fortress of European Turkey; situated at the entrance of the Hellespont or Dardanelles, twenty-four miles south-west of Gallipoli.
- SET**, or **SETS**, a term used by the farmers and gardeners to express the young plants of the white thorn and other shrubs, with which they use to raise their quick or quick-set hedge.
- SETHIANS**, in church-history, christian heretics, so called because they paid divine worship to Seth, whom they looked upon to be Jesus Christ the son of God, but who was made by a third divinity, and substituted in the room of the two families of Abel and Cain, which had been destroyed by the deluge. These heretics appeared in Egypt in the second century; and as they were addicted to all sorts of debauchery, they did not want for followers, and continued in Egypt about two hundred years.
- SETON**, in surgery, a few horse-hairs, small threads, or large packthead, drawn through the skin, chiefly the neck, by means of a large needle or probe, with a view to restore or preserve health by a discharge of matter.
- SETTE**, a vessel very common in the Mediterranean with one deck, and a very long and sharp prow; they carry some two masts, some three, without topmasts. Their yard and sails are all like the mizen; the least of them are of sixty tons burden: they serve to transport cannon and provision for ships of war and the like.
- SETTING**, in astronomy, the withdrawing a star or planet, or its sinking below the horizon.
- SETTING**, in the sea language. To set the land or the sun by the compass, is to observe how the land bears on any point of the compass, or on what point of the compass the sun is. Also when two ships sail in sight of one another, to mark on what point the chased bears, is termed setting the chase by the compass.
- SETTING**, among sportsmen, a term used to express the manner of taking partridges by means of a dog peculiarly trained to that purpose.
- SETTLE**, a market-town of the west riding of Yorkshire, situated forty-five miles west of York.
- SEVENTH**, in musick, an interval called by the Greeks heptachordon. See **MUSICK**.

**SEVERANCE**, in law, the singling or separating of two or more joined in one writ.

**St. SEVERINO**, a city of Naples, in the province of Calabria, situated east longitude  $17^{\circ} 30'$ , north lat.  $39^{\circ} 16'$ . This is also the name of a town in the pope's territories and marquifate of Ancona, situated twenty miles south-east of Loreto.

**SEVERN**, a river of South Britain, which rising in Montgomeryshire, runs east till it enters Shropshire; and having passed by Shrewsbury turns south, and discharges itself into the Bristol channel.

**SEVILLE**, a city of Spain, capital of the province of Andalusia, situated on the river Guadalquivir: in W. long.  $6^{\circ}$ , N. lat.  $37^{\circ} 15'$ .

**SEWER**, in the household, an officer who comes in before the meat of a king or noblemen, to place and range it on the table.

**SEWER** is also a passage or gutter made to carry water into the sea or a river, whereby to preserve the land, &c. from inundations and other annoyances.

**SEX**, something in the body which distinguishes male from female.

**SEXAGENARY**, something relating to the number sixty: thus sexagenary or sexagesimal arithmetick, is a method of computation proceeding by sixties. See **ARITHMETICK**, p. 418.

**SEXAGESIMA**, the second Sunday before Lent, or the next to Shrove-Sunday, so called as being about the sixtieth day before Easter.

**SEXAGESIMALS**. See **ARITHMETICK**, p. 418.

**SEXTANS**, a sixth part of certain things. The Romans having divided their *as* into twelve ounces, or *uncia*, the sixth part of that, or two ounces, was the sextans.

Sextans was also a measure which contained two ounces of liquor, or two cyathi.

**SEXTANT**, in mathematicks, denotes the sixth part of a circle, or an arch comprehending sixty degrees.

The word sextant is more particularly used for an astronomical instrument made like a quadrant, excepting that its limb only comprehends sixty degrees.

**SEXTILE**, the position or aspect of two planets when at sixty degrees distance, or at the distance of two signs from one another.

**SEXTON**, a church-officer, whose business is to take care of the vessels, vestments, &c. belonging to the church, and to attend the minister, church-wardens, &c. at church.

**SEXTUPLE**, in musick, denotes a mix'd sort of triple which is beaten in double time. See **MUSICK**.

**SEXUALISTÆ**, among botanical writers, those who have established the classes of plants upon the differences of the sexes and parts of fructification in plants, according to the modern method, as Linnæus, &c. See **BOTANY**, p. 643.

**SEYNE**, a river of France, which rising near Dijon, in Burgundy, runs north-west through Champagne and the isle of France, through Paris, &c. and crossing Normandy falls into the British channel between Havre-de-grace and Honfleur.

**SHAD**, in ichthyology. See **CLUPEA**.

**SHADOW**, in optics, a privation or diminution of light, by the interposition of any opaque body; or it is a plane where the light is either altogether obstructed, or great-

ly weakened, by the interposition of some opaque body between it and the luminary.

**SHADOW**, in painting, an imitation of a real shadow, effected by gradually heightening and darkening the colours of such figures as by their dispositions cannot receive any direct rays from the luminary that is supposed to enlighten the piece.

**SHAFT of a column**, in building, is the body thereof between the base and capital: so called from its straightness.

**SHAFT**, in mining, is the pit or hollow entrance into the mine.

**SHAFTSBURY**, a borough of Dorsetshire, twenty-five miles north-east of Dorchester; from whence the noble family of Cooper took the title of earl. It sends two members to parliament.

**SHAG**, in ornithology. See **PELICANUS**.

**SHAGREEN**, or **CHAGREEN**, in commerce, a kind of grained-leather, prepared, as is supposed, of the skin of a species of squalus, or hound-fish, called the shagreen, or shagrain; and much used in covering cases, books, &c.

**SHAKLES**, in a ship, are the rings with which the ports are shut fast, by lashing the port-bar to them. There also shakles put upon bilbow-bolts, for confining the men who have deserved corporal punishment.

**SHAMBLES**, among miners, a sort of niches, or landing places, left at such distances in the adits of mines, that the shovel-men may conveniently throw up the ore from shamble to shamble, till it comes to the top of the mine.

**SHAMMY**, or **CHAMOIS-LEATHER**, a kind of leather, dressed either in oil, or tanned; and much esteemed for its softness, pliancy, and being capable of bearing soap without hurt.

The true shammy is prepared of the skin of the chamois-goat. See **CAPRA**.

**SHANK**, in the menage, that part of a horse's fore-leg which lies between the knee and the fetlock.

**SHANKER**, or **CHANCRE**, in medicine. See **MEDICINE**, p. 132.

**SHANNON**, the largest river in Ireland, which rising in the county of Leftrim, runs southwards, dividing the provinces of Leinster and Connaught; and then turning south-west, runs through the province of Munster; and passing by the city of Limeric, afterwards falls into the western or Atlantic ocean.

**SHARE of a plough**, that part which cuts the ground, the extremity forwards being covered with a sharp-pointed iron, called the point of the share; and the end of the wood behind, the tail of the share. See **AGRICULTURE**, p. 54.

**SHASTER**, or **SHASTRAM**, a sacred book, containing the religion of the Bamans: it consists of three tracts; the first of which contains their moral law; the second, the ceremonial; and the third delivers the peculiar observances for each tribe of Indians.

**SHEAT of a plough**, a part passing through the beam, and fastened to the share. See **AGRICULTURE**, p. 54.

**SHEATHING**, in the sea-language, is the casing that part of a ship which is to be under water, with fir board of an inch thick; first laying hair and tar, mixed together, under the boards, and then nailing them on, in order to prevent worms from eating the ship's bottom.

**SHEATS**, in a ship, are ropes bent to the clews of the sails;

fails; serving, in the lower fails, to haul aft the clews of the fail; but, in top-fails, they serve to haul home the clew of the fail close to the yard-arm.

**SHEEP**, in zoology. See **OVIS**.

**SHEERING**, in the sea-language. When a ship is not steered steadily, they say she sheers, or goes sheering; or when at anchor she goes in and out, by means of the current of the tide, they also say she sheers.

**SHEERS**, in a ship, are two masts set across at the upper end of each other; a contrivance generally used for setting or taking out the masts of a ship, where there is no hulk to do that office.

**SHEFFIELD**, a market-town of Yorkshire, 38 miles south-west of York.

**SHEFFORD**, a market-town of Bedfordshire, seven miles south-west of Bedford.

**SHEFFNEL**, a market-town of Shropshire, fourteen miles east of Shrewsbury.

**SHEIK**, an officer in the mosques of Egypt, whose business is the same with that of the imans of Constantinople.

**SHEIK-BELLET**, in the Turkish affairs, a magistrate, answering to the mayor of a city with us.

**SHIELDS**, a port-town of the bishopric of Durham, situated at the mouth of the river Tyne, eight miles east of Newcastle.

**SHEKEL**, in Jewish antiquity, an ancient coin, worth 2 s.  $\frac{3}{4}$  d. sterling.

**SHELF**, among miners, the same with what they otherwise call fast ground, or fast country; being that part of the internal structure of the earth, which they find lying even; and in an orderly manner, and evidently having retained its primitive form and situation.

**SHELL**, in natural history, a hard, and as it were stony covering, with which certain animals are defended, and thence called shell-fish.

As to the formation of a shell, it is now generally allowed to be formed by a viscus fluid composed of glue, and several sandy particles of an exquisite fineness, which are transmitted through an infinite number of little channels to the pores where it transpires, condenses, and hardens. When the animal increases in bulk, and the extremity of her body is not sufficiently covered, it continues to evacuate and build in the same manner, finishing or repairing her habitation. This viscus matter is proved, by undeniable experiments, to arise from the body of animals, and not from the shell, as some have imagined.

*Fossil* **SHELLS**, those found buried at great depths in earth, and often immersed in the hardest stones. These fossil shells, as well as those found lying on the sea-shore, make an excellent manure, especially for cold clayey lands; upon which it does not produce nearly so great an effect for the two first years, as it does in the succeeding ones; the reason of which is, that it is not then sufficiently mixed, but in succeeding time it breaks itself into a number of very small particles, and these all become intimately blended with the molecules of earth, and produce their effect more properly.

**SHELTIE**, a small but strong kind of horse, so called from Shetland, or Zetland, where they are produced.

**SHEPPY**, an island at the mouth of the river Medway, making part of the county of Kent.

**SHERARDIA**, in botany, a genus of plants belonging

to the tetrandria monogynia class. The corolla consists of one funnel-shaped petal; and there are two seeds having three teeth. The species are three, only one of them, *viz.* the arvensis, or little field-madder, a native of Britain.

**SHERBORN**, a market-town, twelve miles south-west of York.

**SHERBRO**, a fort at the mouth of the river Sherbro, in Guinea, formerly in the possession of the English.

**SHERENESS**, a fort on the north-west part of the isle of Sheppey, situated at the mouth of the river Medway, to defend its entrance.

**SHERIFF**, an officer in each county of England, nominated by the king, invested with a judicial and ministerial power, and who takes place of every nobleman in the county during the time of his office.

**SHERIFF** in Scots law. See **LAW**, Tit. iv. 1.

**SHEW-BREAD**, among the Hebrews, the name given to those loaves of bread which the priests placed every sabbath day upon the golden table in the sanctuary. The shew-bread consisted of twelve loaves, according to the number of the tribes; these were served up hot on the sabbath day, and at the same time the stale ones which had been exposed all the week were taken away. It was not lawful for any one to eat of those loaves but the priests only; this offering was accompanied with salt and frankincense, which was burnt upon the table at the time they set on fresh loaves.

**SHIELD** an ancient weapon of defence, in the form of a light buckler, borne on the arm, to turn off lances, darts, &c.

**SHIELD**, in heraldry, the escutcheon or field on which the bearings of coats of arms are placed. See **ESCUTCHEON**.

**SHILLING** an English silver coin. See **MONEY**.

**SHIP**, a general name for all large vessels with sails, fit for navigation on the sea, except galleys, which go with oars, and smack-fails. See **NAVIGATION**.

A ship is undoubtedly the noblest machine that ever was invented; and consists of so many parts, that it would require a whole volume to describe it minutely. However, we shall endeavour to satisfy the reader the more fully on this head, as it is an article of the utmost importance. And first, to give an idea of the several parts and members of a ship, both external and internal, with their respective names in the sea-language, in Plate CXLVIII, is represented a ship of war of the first rate, with rigging, &c. at anchor: Where A is the cat-head; B, the fore-chains; C, the main chains; D, the mizzen-chains; E, the entering part; F, the hawse holes; G, the poop lanterns; H, the ches-tree; I, the head; K, the stern.

L, The bowprit. 1, 2, Yard and fail. 3, Gammoning. 4, horse. 5, Bob stay. 6, Sprit-fail sheets. 7, Pendants. 8, Braces and pendants. 9, Halliards. 10, Lifts. 11, Clew-lines. 12, Sprit-fail horses. 13, Bunt-lines. 14, Standing lifts. 15, Sprit fail top. 16, Flying jib boom. 17, Flying jib stay and fail. 18, Halliards. 19, Sheets. 20, Horses.

M, The sprit-fail top-mast. 21, Shrouds. 22, 23, Yard and fail. 24, Sheet. 25, Lugs. 26, Braces and pendants. 27, Cap. 28, Jack staff. 29, Truck. 30, Jack flag.

N, The fore-mast. 31, Runner and tackle. 32, 33, Shrouds. 34, Laniards. 35, Stay and laniard. 36, Preventer

Preventer-stay and laniard 37, Woollding the mast. 38, Yard and fail. 39, Horfes. 40, Top. 41, Crow-foot. 42, Jeers. 43, Yard tackles. 44, Lifts. 45, Braces and pendants. 46, Sheets. 47, Fore tacks. 48, Bow-lines and bridles. 49, Fore bunt-lines. 50, Fore leech lines. 51, Fore top rops. 52, Puttock shrouds.

O, The fore top mast. 53, 54, Shrouds and laniards. 55, Yard and fail. 56, Stay and fail. 57, Runner. 58, Back stays. 59, Halliards. 60, Lifts. 61, Braces and pendants. 62, Horfes. 63, Clew-lines. 64, Bow-lines and bridles. 65, Reef-tackles. 66, Sheets. 67, Bunt-lines. 68, Cross trees. 69, Cap.

P, The fore top gallant mast. 70, 71, Shrouds and laniards. 72, Yard and fail. 73, Back stays. 74, Stay. 75, Lifts. 76, Clew lines. 77, Braces and pendants. 78, Bow-lines and bridles. 79, Flag staff. 80, Truck. 81, Flag-staff stay. 82, Flag of lord high admiral.

Q, The mainmast. 83, 84, Shrouds. 85, Laniards. 86, Runner and tackle. 87, Pendant of the gornet. 88, Guy of ditto. 89, Sail of ditto. 90, Stay. 91, Preventer stay. 92, Stay tackle. 93, Woollding the mast. 94, Jeers. 95, Yard tackles. 96, Lifts. 97, Braces and pendants. 98, Horfes. 99, Sheets. 100, Tacks. 101, Bow-lines and bridles. 102, Crow foot. 103, Top rope. 104, Top. 105, Bunt-lines. 106, Leech-lines. 107, Yard and fail.

R, The main top mast. 108, 109, Shrouds and laniards. 110, Yard and fail. 111, Puttock shrouds. 112, Back stays. 113, Stay. 114, Stay fail and stay halliards. 115, Runnets. 116, Halliards. 117, Lifts. 118, Clew-lines. 119, Braces and pendants. 120, Horfes. 121, Sheets. 122, Bow-lines and bridles. 123, Bunt-lines. 124, Reef tackles. 125, Cross trees. 126, Cap.

S, The main top gallant mast. 127, 128, Shrouds and laniards. 129, Yard and fail. 130, Back stays. 131, Stay. 132, Stay fail and halliards. 133, Lifts. 134, Braces and pendants. 135, Bow-lines and bridles. 136, Clew-lines. 137, Flag staff. 138, Truck. 139, Flag staff stay. 140, Flag standard.

T, The mizzen mast. 141, 142, Shrouds and laniards. 143, Pendants and burtons. 144, Yard and fail. 145, Crow foot, 146, Sheet. 147, Pendant lines. 148, Peck brails. 149, Stay fail. 150, Stay. 151, Derric and span. 152, Top. 153, Cross jack yard. 154, Cross jack lifts. 155, Cross jack braces. 156, Cross jack slings.

V, The mizzen top mast. 157, 158, Shrouds and laniards. 159, Yard and fail. 160, Back stays. 161, Stay. 162, Halliards. 163, Lifts. 164, Braces and pendants. 165, Bow lines and bridles. 166, Sheets. 167, Clew-lines. 168, Stay fail. 169, Cross trees. 170, Cap. 171, Flag staff. 172, Flag staff stay. 173, Truck. 174, Flag union. 175, Ensign staff. 176, Truck. 177, Ensign. 178, Poop ladder. 179, Bower cable.

Thus we have pointed out the external parts, masts, rigging, &c. an account of all which may be seen under their respective articles MAST, HULL, ROPE, RUD-  
DER, &c.

In Plate CXLIX. is represented the section of a first-  
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rate ship of war, shewing the inside thereof: where A is the head; containing, 1, The stem. 2, The knee of the head, or cut water. 3, The lower and upper cheek. 4, The tail-board. 5, The figure. 6, The gratings. 7, The brackets. 8, The false stem. 9, The breast hooks. 10, The hause-hole. 11, The bulk head, forward. 12, The cat-head. 13, The cat-book. 14, Necessary seats. 15, The manger within board. 16, The bowsprit.

B, Upon the forecastle. 17, The gratings. 18, The partners of the fore mast. 19, The gun wale. 20, The belfry. 21, The funnel for the smoke. 22, The gangway going off the forecastle. 23, The forecastle guns.

C, In the forecastle. 24, The door of the bulk head, forward. 25, The officers cabbins. 26, The stair case. 27, The fore top fail sheet bits. 28, The beams. 29, The car lines.

D, The middle gun-deck forward. 30, The fore-jeer bits. 31, The oven and furnace of copper. 32, The captain's cook-room. 33, The ladder, or way up into the forecastle.

E, The lower gun-deck forward. 34, The knees fore and aft. 35, The spirketings, or the first streak next to each deck; the next under the beams being called clamps. 36, The beams of the middle gun-deck, fore and aft. 37, The car-lines of the middle gun-deck, fore and aft. 38, The fore bits. 39, The after, or main bis. 40, The hatchway to the gunner's and boat-swain's store-rooms. 41, The jeer capton.

F, The orlop. 42, 43, 44, The gunner's, boatswain's, and carpenter's store-rooms. 45, The beams of the lower gun-deck. 46, 57, The pillars and the riders, fore and aft. 48, The bulk head of the store-rooms.

G, The hold. 49, 50, 51, The foot-hook rider, the floor-rider, and the standirt, fore and aft. 52, The pillars. 53, The step of the fore mast. 54, The keelson, or false keel, and dead rising. 55, The dead wood.

H, A midships in the hold. 56, The floor timbers. 57, The keel. 58, The well. 59, The chain pump. 60, The step of the main mast. 61, 62, Beams and car-lines of the orlop, fore and aft.

I, The orlop a midships. 63, The cable tire. 64, The main hatchway.

K, The lower gun-deck a-midships. 65, The ladder leading up to the middle gun-deck. 66, The lower tire or ports.

L, The middle gun-deck a-midships. 67, The middle tire ports. 68, The entering port. 69, The main jeer bits. 70, Twilted pillars or stantions. 71, The capton. 72, The gratings. 73, The ladder leading to the upper deck.

M, The upper gun-deck a-midships. 74, The main top-fail sheet bits. 75, The upper partners of the main mast. 76, The gallows on which spare top masts, &c. are laid. 77, The fore sheet blocks. 78, The rennets. 79, The gun wale. 80, The upper gratings. 81, The drift brackets. 82, The pifs dale. 83, The cap-fion pall.

N, Aaft the main mast. 84, The gang-way off the quarter-deck. 85, The bulkhead of the coach. 86, The stair case down to the middle gun-deck. 87, The beams

of the upper deck. 88. The gratings about the main-mast. 89. The coach, or council-chamber. 90. The stair-case up to the quarter-deck.

O, The quarter-deck. 91, The beams. 92, The carlines. 93, The partners of the mizzen mast. 94, The gangway up to the poop. 95, The bulk-head of the cuddy.

P, The poop. 96, The trumpeter's cabin. 97, The taffarel.

Q, The captain-lieutenant's cabin.

R, The cuddy, usually divided for the master and secretary's officers.

S, The state-room, out of which is made the bed-chamber, and other conveniences for the commander in chief. 98, The entrance into the gallery. 99, The bulk-head of the great cabin. 100, The stern-lights and after galleries.

T, The ward-room, allotted for the lieutenants and land-officers. 101, The lower gallery. 102, The steerage and bulk-head of the ward-room. 103, The whip-staff, commanding the tillar. 104, The after stair-case down to the lower gun-deck.

V, Several officers cabins abast the main-mast, where the soldiers generally keep guard.

W, The gun-room. 105, The tillar commanding the rudder. 106, The rudder. 107, The stern-post. 108, The tillar-transom. 109, The several transoms, viz. 1, 2, 3, 4, 5. 110, The gun-room ports, or stern chafe. 111, The bread-room scuttle, out of the gun-room. 112, The main capston. 112, The main capston. 113, The pall of the capston. 114, The partner. 115, The bulk-head of the bread room.

X, The bread-room. Y, The steward's room, where all provisions are weighed and served out. Z, The cock-pit, where are subdivisions for the purser, the surgeon, and his mates.

AA, The platform, or orlop, where provision is made for the wounded in time of service. 116, The hold abast the main-mast. 117, The step of the mizen mast. 118, The keelson, or false keel. 119, The dead-wood, or rising.

*Different kinds of SHIPS.* All ships at first were of the same form, whatever uses they were designed for; but the various ends of navigation, some of which were better answered by one form, some by another, soon gave occasion to build and fit out ships, not only different in bigness, but also in their construction and rigging: and as trade gave occasion to the fitting out large fleets of different kinds of merchant-ships; so ships of war became necessary, to preserve them to their just proprietors.

SHIPS OF WAR have three masts, and a bowsprit, and are sailed with square sails; the other parts being as described above, and represented in Plate CXLVIII. They are divided into several orders, called *rates*; that is, their degree or distinction as to magnitude, burden, &c. The rate is usually accounted by the length and breadth of the gun-deck, the number of tons, and the number of men and guns the vessel carries. There are six rates, viz.

A common first-rate man of war has its gun-deck from 159 to 178 feet in length, and from 44 to 51 broad. It contains from 1313 to 2000 tons; has from 706 to 1000 men, and carries from 96 to 100 guns. But one of the most considerable first-rate ships was that built at Woolich

in 1701; the dimensions whereof are as follow: The length, 210 feet; number of guns, 110; number of men, 1250; number of tons, 2300; draught of water, 22 feet; the main-sail in length 54 yards. depth 19; main mast in length 39 feet, in diameter 38 inches; weight of the anchor 82 Cwt. 1 qr 14 lb; cable in length 200 yards, diameter 22 inches.—The expence of building a common first rate, with guns, tackling, and rigging is computed at 60,000 *l.* sterling.

Second rate ships have their gun-decks from 153 to 165 feet long, and from 41 to 46 broad: they contain from 1086 to 1482 tons; and carry from 524 to 640 men, and from 84 to 90 guns.

Third rates have their gun-decks from 140 to 150 feet in length, from 37 42 feet broad: they contain from 871 to 1262 tons; carry from 389 to 476 men, and from 64 to 80 guns.

Fourth rates are in length on the gun-decks from 118 to 146 feet, and from 29 to 38 broad: they contain from 448 to 915 tons; carry from 226 to 346 men, and from 48 to 60 guns.

Fifth rates have their gun-decks from 100 to 120 feet long, and from 24 to 31 broad: they contain from 259 to 542 tons; and carry from 145 to 190 men, and from 26 to 44 guns.

Sixth rates have their gun-decks from 87 to 95 feet long, and from 22 to 25 broad: they contain from 152 to 256 tons; carry from 40 to 110 men, and from 16 to 24 guns.

It is to be observed, that the new-built ships are much larger, as well as better, than the old ones of the same rate; whence the double numbers all along; the larger of which express the proportions of the new built ships, as the less those of the old ones.

MERCHANT SHIPS are estimated by their burden; that is, by the number of tons they bear, each ton reckoned at 2000 lb weight; this estimate being made by gauging the hold, which is the proper place of loading.

Besides those mentioned above, there are other forms: as, 1. The bilander, (Plate CXLIX. fig. 2.) which has rigging and sails not unlike a hoy, only broader and flatter: bilanders are seldom above twenty-four tons, and can lie nearer the wind than a vessel with cross-sails can do. 2. Bomb-vessels, (*ibid.* fig. 3.) have sometimes three masts, and square sails, as represented; but they are also frequently ketch-fashion, with one mast and a mizen. 3. Brigantines (*ibid.* fig. 4.) are now disused; but had two masts, and square sails. 4. Hag-boats (*ibid.* fig. 5.) are masted and sailed ship-fashion, but are built in the form of the Dutch fly-boat. 5. Hoys (*ibid.* fig. 6.) are fitted with one mast and a sprit-sail; whose yards stand fore and aft like a mizen, so that it can lie near the wind. 6. Hulks (*ibid.* fig. 7.) are generally old ships cut down to the gun-deck, and fitted with a large wheel, for men to go in when careening: it has also several capstons fixed on its deck, for setting ships masts. 7. Ketches (*ibid.* fig. 8.) are fitted with two masts; and their main-sail and top-sail stand square as those of ships do, but their fore-sail and jibbs as those of hoyes do. 8. Lighters (*ibid.* fig. 9.) are vessels made use of for laying down or shifting the moorings, for bringing ashore or carrying on broad ships cables, anchors, &c. 9. Pinks (*ibid.* fig. 10.)

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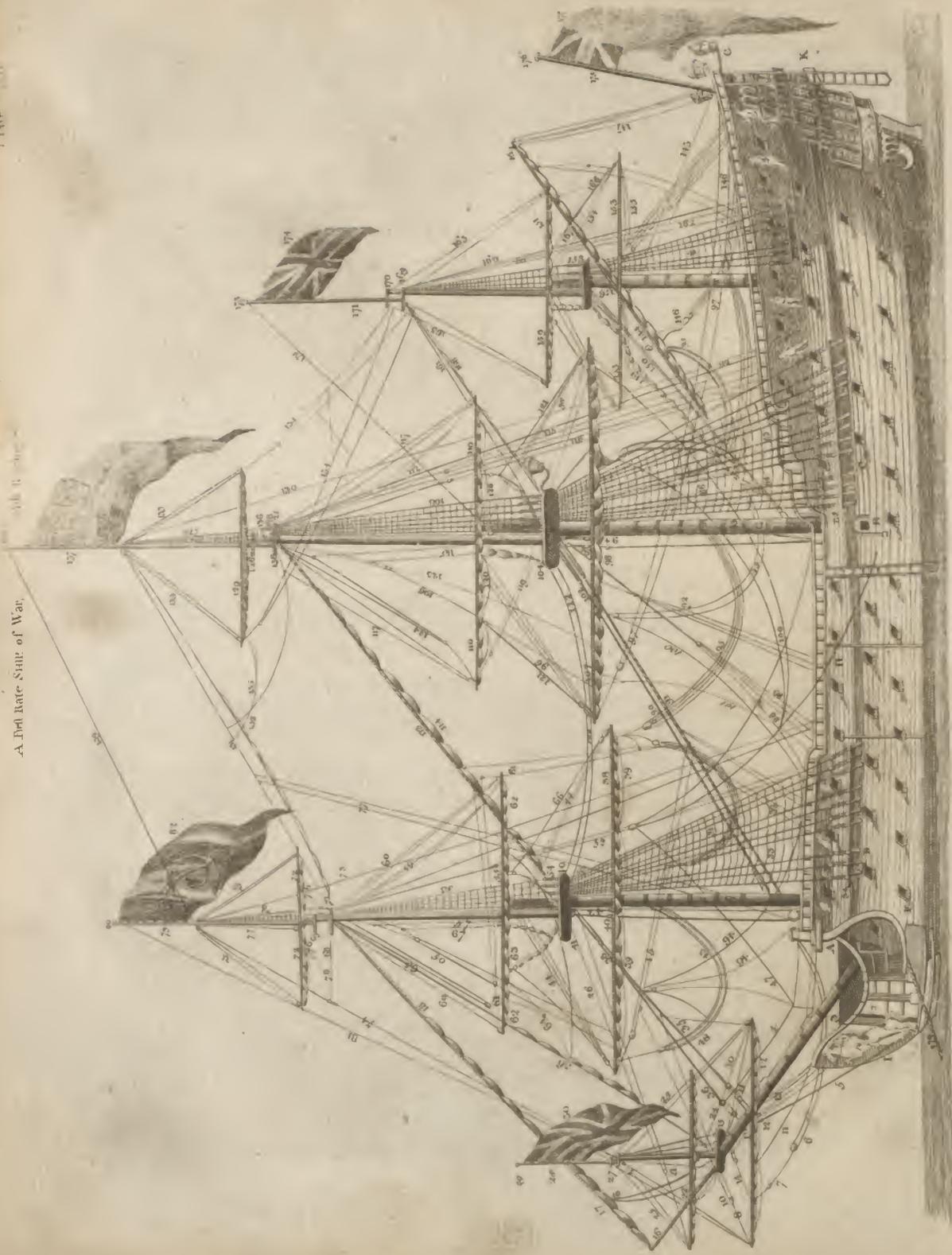
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A. Del. Rate Ship of War.



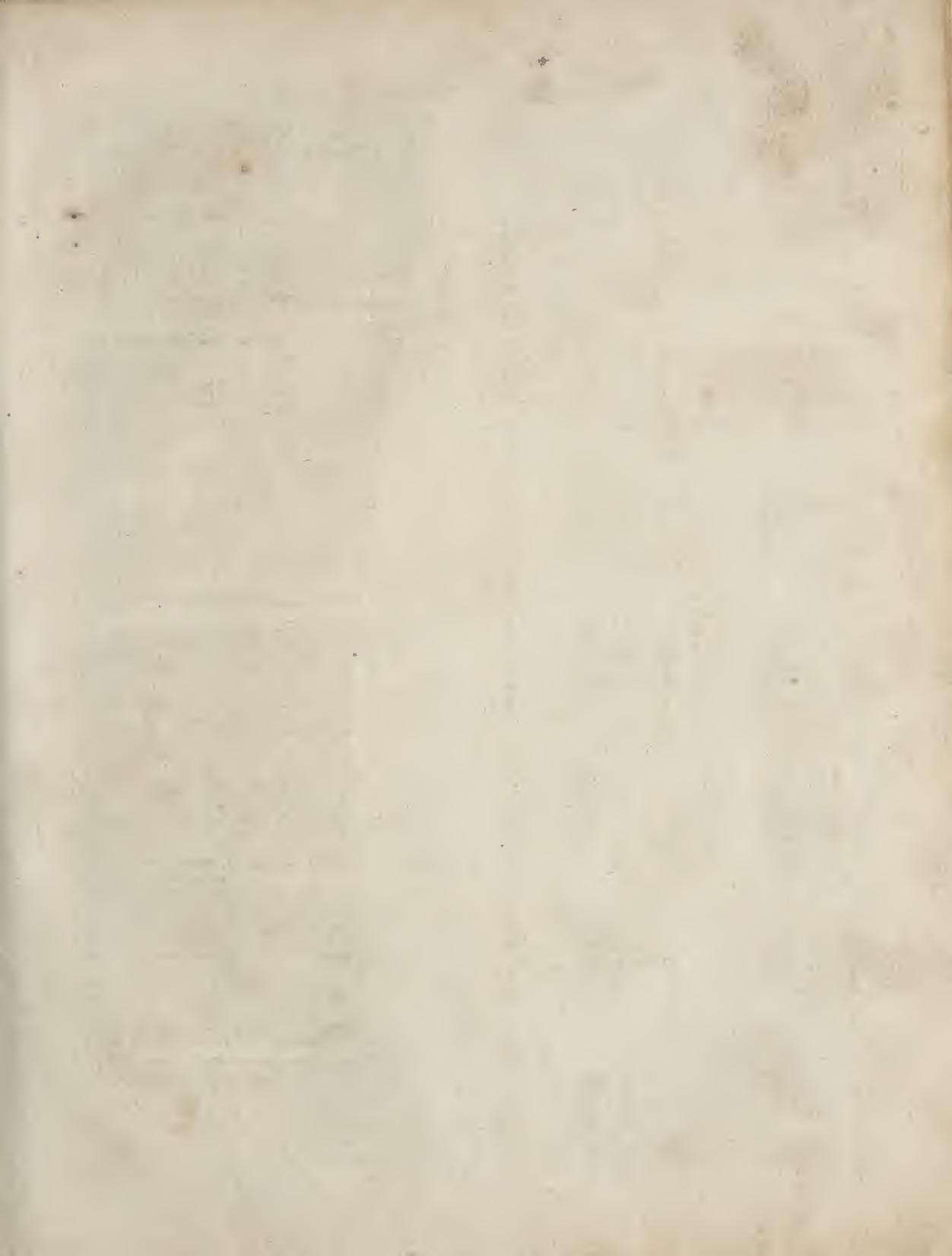


Fig. 7. *Black*



Fig. 8. *Ketch*



Fig. 9. *Yacht*



Fig. 10. *Sloop*



Fig. 11. *Brig*



Fig. 12. *Shallop*



Fig. 13. *Whirlboat*



Fig. 14. *Frigate*



Fig. 15. *Bomb Vessel*



Fig. 16. *Gun*



Fig. 17. *Bomb Vessel*



Fig. 18. *Frigate*



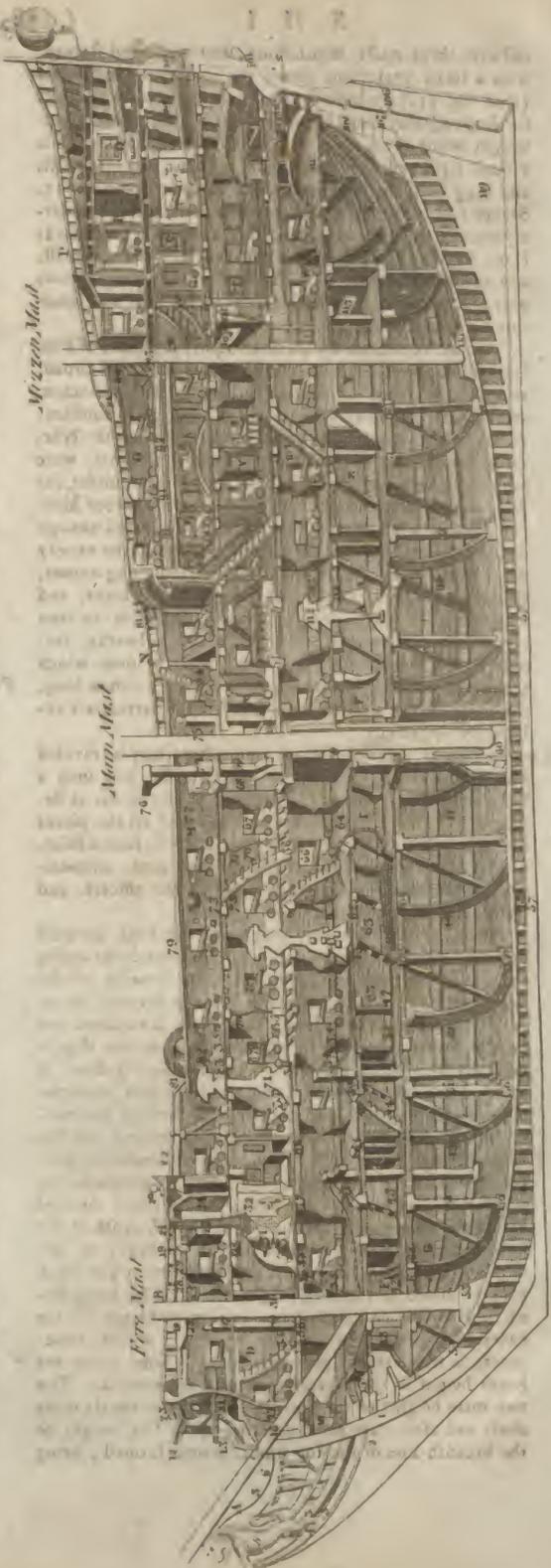
Fig. 19. *Blunder*



Fig. 20. *Lighter*



Fig. 1. The Section of a First Rate Ship of War, Shewing its various Timbers and Apartments



fail with three masts, ship-fashion; but are round sterned, with a small projection above the rudder. 10. Punts (*ibid.* fig. 11.) are built square, and used about the docks for fetching clay and other services as the master shipwright wants them for. 11. Shallop (*ibid.* fig. 12.) is a small light vessel, with only a small main and fore mast, and legg sails, to haul up and let down on occasion. 12. Sloops (*ibid.* fig. 13) have only one mast, with shoulder-of-mutton, square, lugg, and smack sails. 13. Smacks (*ibid.* fig. 14.) are transporting vessels, with one mast, and an half sprit-fail. 14. Yachts (*ibid.* fig. 15.) have only one mast, with an half sprit or smack sail, and sometimes ketch-fashion.

The most celebrated ships of antiquity are those of Ptolemy Philopater. One was 280 cubits long, 38 broad, and 48 high, each cubit being 1 English foot  $5\frac{1}{4}$  inches, and carried 400 rowers, 400 sailors and 3000 soldiers. Another which the same prince made to sail on the Nile, we are told, was half a stadium long. Yet these were nothing in comparison with Hiero's ship, built under the direction of Archimedes; on the structure whereof Mofch on wrote a whole volume. There was wood enough employed in it to make 50 galleys: it had all the variety of apartments of a palace; such as banqueting-rooms, galleries, gardens, fish ponds, stables, mills, baths, and a temple to Venus. It was encompassed with an iron rampart, eight towers, with walls and bulwarks, furnished with machines of war; particularly one, which threw a stone of 300 pounds, or a dart 12 cubits long, the space of half a mile, with many other particulars related by Athenæus.

*Construction of SHIPS.* Naval architecture may be divided into three principal parts: 1. To give the ship such a figure and proportion as may suit the service she is designed for. 2. To find the true form of all the pieces of timber that shall be necessary to compose such a solid. 3. To make proper accommodations for guns, ammunition, provisions, and apartments for all the officers, and likewise room for the cargo.

As to the first part, the length of the keel, greatest breadth, depth in the hold, height between decks and in the wale, and sometimes the height and breadth of the wing-transom, in ships for the merchants service, are agreed on by contract; and from these dimensions the builder forms a draught suitable to the trade the ship is designed for. The first thing that is generally done, is to lay down the keel, the stem, and stern-post, upon the sheer-plane, or plane supposed to pass through the middle-line of the keel, stem, and stern-post, cutting the ship in two halves lengthwise. They next determine the proper station of the mid-ship timber, where a perpendicular is erected, and is generally about two thirds of the keel before the stern-post: on this line the given depth of the hold is set off, from the upper-side of the keel; to obtain which point, the thickness of all the timber and plank must be added to the height agreed on. This being fixed, will enable us to determine the upper-height of the extreme or greatest breadth of the ship; which, sometimes, is that very point; and from the same place the lower height of the breadth must be determined. The two main heights of the breadth-lines, which nearly unite abaft and afore, are next determined. The height of the breadth-line of the top-timber is next formed; being

limited in the midship by contract, but afore and aft only by the judgment and fancy of the artist. If a square stern is designed, the breadth at the wing-transom is limited, being generally about two thirds of the greatest breadth. The artist next fixes the breadth of the top-timber, and then describes the two half-breadth lines. After these are formed the places where the several timbers are fixed: and for forming the midship-frame, radii are assumed at pleasure, till the sweeps are made to please the fancy and judgment of the artist. When this midship-frame is formed, a pattern or mould is made to fit exactly to the curve, and the dead-rising, or water-line; and by this and a hollow mould, all the timbers are formed, as far as the rising-line, which is parallel to the lower height of the breadth-line.

We come next to consider the upper-works, or all that is above water, called the dead-work: and here the ship must be narrower, by which means she will strain less by working the guns, and the main-fail will be easier trimmed, as the shrouds spread less than they would otherwise do. But though these advantages are gained by narrowing a ship above water, yet great care must be taken not to narrow her too much, lest there should not be sufficient room upon the upper deck for the guns to recoil. The security of the masts should likewise be considered, which require sufficient breadth to spread the shrouds: though this may be assisted by enlarging the breadth of the channels.

*Principal qualities belonging to SHIPS.* A ship of war should carry her lower tier of guns four or five feet above water; a ship for the merchants service should stow the cargo well; and both of them should be made to go well, carry a good sail, steer well, and lie-to easily in the sea. 1. To make a ship carry a good sail, Mr Du Hamel recommends a flat floor-timber, and somewhat long, or the lower futtock pretty round; also a straight upper futtock, and the top timber to throw the breadth out aloft; and at any rate, to carry her main-breadth as high as the lower-deck; for if the rigging be well adapted to such a body, and the upper-works heightened as much as possible so as all to concur to lower the centre of gravity, there will be no room to doubt of her carrying a good sail. 2. To make a ship steer well, and answer the least motion of the helm, the fashion-pieces should be well formed, the tuck carried pretty high, and the midship-frame carried pretty forward; also there should be a considerable greater draught of water abaft than afore, a great rake forward, and none abaft, and a snug quarter-deck and fore-castle: all these will make a ship steer well. But to make her feel the least motion of her helm, it will be necessary to regard her masts; for a ship that goes well, will certainly steer well. 3. To make a ship carry her guns well out of the water, is effected by a long floor-timber, and not of great rising, a very full midship-frame, and low tuck; with light upper-works. 4. To make a ship go smoothly through the water, without pitching hard, her keel should be long, her floor long and not rising high afore or aft; the area or space contained in the fore-body should also be duly proportioned to that of the after-body, according to the respective weights they are to carry. 5. To make a ship keep a good wind, she should have a good length by the keel, not too broad, but pretty deep in the hold; which will make her floor-timber

timber short, and rising great. As such a ship will meet with great resistance in the water going over the broad side, and but little when going-a-head, she will not fall much to the leeward. Now some ship-builders imagine, that it is impossible to make a ship carry her guns well, carry a good sail, and be a prime sailer at the same time; because it requires a very full bottom to gain the two first qualities, and a sharp-bottomed ship best answers the latter: but when it is considered, that a full ship will carry a great deal more sail than a sharp one, a good artist may so form the body as to have all these three good qualities united, and likewise steer well; for which purpose, Mr Du Hamel recommends somewhat more in length than has been commonly practised.

SHIPTON, a market-town, twenty-four miles south-east of Worcester.

SHIRE, in geography, signifies the same as county; being originally derived from a Saxon word which signifies *to divide*.

SHIVERS, in the sea language, names given to the little rollers or round wheels of pulleys.

SHOAD, among miners, denotes a train of metalline stones, serving to direct them in the discovery of mines.

SHOAL, in the sea-language, denotes a place where the water is shallow.

SHOE, a covering for the foot, usually made of leather, by the company of cordwainers.

SHOE for an anchor, in a ship, the place for the anchor to rest, and fitted to receive the stock, &c. so as to prevent the sheets, tacks, and other running rigging, from galling, or being entangled with the blocks.

SHORE, a place washed by the sea, or by some large river,

Count Martigli divides the sea-shore into three portions: the first of which is that tract of land which the sea just reaches in storms and high tides, but which it never covers; the second part of the shore, is that which is covered in high tides and storms, but is dry at other times; and the third is the descent from this, which is always covered with water.

SHOREHAM, a borough and port town of Sussex, twenty-five miles east of Chichester. It sends two members to parliament.

## SHORT-HAND WRITING.

AS STENOGRAPHY, or the Art of SHORT-HAND WRITING, when well understood, and rendered familiar by practice, is attended with many valuable consequences, we shall, without attempting to enumerate

the infinite variety of systems that have been published, furnish our readers with that system which appears to be the most easy, beautiful, and expeditious, and at the same time calculated for general use.

### P A R T I.

THE Alphabet being the foundation upon which the perfection of the art depends, great care must be taken to establish it in the best manner. All the simple sounds must be represented by the shortest marks possible. We must, therefore, not only reject the complex marks established by custom in our common alphabet, but also those letters themselves whose sounds may always be signified by others; and simple marks must be provided for such simple sounds as are by custom represented by two letters a-piece: for which reason, it is necessary to examine the alphabet, and to fix the number of characters, before we proceed to investigate the marks which are to represent them. First, then, let us consider what number of consonants may be requisite. We shall afterwards treat of the vowels, which are to be represented by points or dots.

The consonants, according to our usual reckoning, are, *b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, v, w, x, y, z*. But custom differs from nature in inserting the letters *c, q, w, x, y*, and in omitting *sh, zh, th, dh, ch*: for *c* having always either the sound of *k* or *s*, *q* that of *koo*, *w* of *oo*, *x* of *ks*, and *y* of *i*; in an alphabet according to nature none of these could have found a place; and *sh, zh, th, dh, ch*, representing single consonantal sounds as much as *ph* does, whose power is that of *f*, ought all to have been denoted by single characters, as most of them are in the alphabets of other languages.

The natural alphabet, therefore, might have been taken

for our short-hand one, rejecting the superfluous letters *c, q, w, x, y*, and inserting in their stead *sh, zh, th, dh, ch*: but having some marks that were not conveniently applicable to any other purpose, and it being a compendium to represent two letters by a single character, as in the *q* and *x*, and some ease to the reader to retain at the beginning of words the *w* and *y*, to which he has been long accustomed; we shall, totally rejecting the *c*, appropriate distinct marks to denote *q, x, w, y*, when they are initial letters; not scrupling however, in other situations, if it prove more convenient, to denote them by *k, ks, oo* and *i*, respectively.

*Zh* never had any particular mark to signify it by; and custom has, for a long period of time, ceased to make any distinction in writing between the *th* and *dh*: and as the adherence to nature in making nice distinctions, where custom has not, would be so far, in this case, from serving any valuable purpose of short-hand, that it would rather, on the contrary, render the learning to write and read it more difficult, we have, in pursuance of our plan, complied with custom in dropping the *zh*, and marking the sounds both of *th* and *dh* by the same character.

*S* and *z* bear the same relation to each other, that the *sh* and *dh* do; and the sound of *z* in our customary way of writing is very frequently expressed by *s*, except in cases when it occurs at the beginning of words, which happen but very seldom. These considerations induce us to secure the great convenience which arises from signifying both *s* and

and z by one mark. And, for a like reason, we shall make one mark representative both of *f* and *v*. The sense of the place will easily discover, to a man tolerably acquainted with English, which of the two it must there represent; and the reader will be taught, when the characters are appropriated to the consonants, how, in most cases, entirely to remove any little ambiguity that possibly might arise from it. Our alphabet will then consist of the following consonants, *viz.* *b, d, [f v] g, h, j, k, l, m, n, p, q, r, [s z], t, w, x, y, ch, sh, th.*

The number of our consonants being thus settled, and the reasons for fixing upon that number being given; the next business must be, to invent as many simple marks, easy to be made and distinguished from each other, as are necessarily required to represent them. They must be simple, if brevity be consulted; and they must be easily distinguishable from each other, to avoid the confusion arising from mistaking one letter for another.

Nature affords us four straight lines, sufficiently distinguishable from each other, by their horizontal, perpendicular, and inclined position, to execute our design by; (see Plate CL. N<sup>o</sup> 1.) but it affords only these four. In this scarcity of straight lines, recourse must be had to curved ones for a further supply. The four straight lines bent in the following manner, that is to say, the horizontal upwards and downwards, the perpendicular and inclined one to the right and left, will each of them furnish two more very good short-hand marks; *ibid* N<sup>o</sup> 2.

The number of marks thus increased still falls short of supplying our wants. The best expedient to remedy this defect, is the addition of a little twirl to the beginning of as many of the foregoing marks as there will be occasion for. It is easily and quickly made, when the marks are formed separately; and the twirled marks are joined to preceding ones in as little time as the plain ones. N<sup>o</sup> 3. 4.

A sufficient number of proper marks being thus obtained, it remains that each of them be appropriated to the particular consonant which it is to represent. Easy as this may seem, it is, however, a point of the greatest nicety; and demands, not only the most careful consideration, but also the most assiduous application to continual trials and alterations. A short-hand alphabet may have all its characters simple, easy, and distinguishable, when separately formed; and yet not be a perfect one. To merit that title, it is further requisite, that they be so contrived and adjusted, that all the consonants occurring in any word may be easily, beautifully, and interlineally joined together, betwixt two given parallel lines, without taking off the pen. Experience has taught quick writers even of long-hand, that the joining all the letters of a word together contributes much to dispatch, though they are obliged to make little additional strokes for that purpose.

Let us then consider, to what particular consonant each of our marks is to be appropriated; and begin with the four straight lines.

The first of these lines, *viz.* the horizontal, as it goes straight forwards, can never exceed the limits of the given parallels, whatever part it begins from; and therefore, in a short-hand formed for lineal beauty, it must be appropriated to that consonant, which, of all others, occurs the oftenest, and challenges, of right, the most commodious character for beauty and dispatch. Now the consonant that occurs the most frequently in our language (and perhaps in

most others) is the *r*; which has a property, peculiar to itself, of mixing with other consonants before or after it, without the intervention of a vowel. The plural number of most of our substantives, and the third person singular of our verbs, are formed by it; which must occasion the most frequent repetition of it; so that, being undoubtedly the commonest of all our consonants, it must of necessity be denoted by the horizontal straight line.

The second straight line, or perpendicular, is also a very easy mark, and, separately made, even preferable to the other; but as, in union with others, it may endanger our descending below the line, it must therefore be allotted to a common consonant, and one also that will the least occasion us to run that hazard. Now the *t* has, in fact, these and other properties that entitle it to this perpendicular straight line.

The third straight line, by its peculiar inclination, is adapted to a very easy and convenient joining with other characters; because our customary method of inclining the letters, in common writing, teaches us to form it with equal readiness upwards or downwards, as the keeping the previous or following marks within the prescribed parallels shall require. The consonant, therefore, that claims this character, is the *r*, which makes so many of our double consonants (as we call them) and admits any other single one to follow it immediately. The straight line then which slopes downwards to the left, is *r*.

The last line of the four straight ones, by its direction or slope to the right, is awkward to make (and therefore never is made) upwards, like the foregoing, to which it unites the most readily. Its properties, upon trial, suit best with the occurrence of the consonants *f* or *v*.

The twirl being formed to the left hand in these four marks, (N<sup>o</sup> 5.) disqualifies them from an easy junction with any preceding consonant. They must then, for that reason, be assigned to such consonants as occur the seldomest in the middle or at the end of words, or to such as may be otherwise signified when they do occur in such situations. Now the *h*, or *j*, are rarely to be met with in the middle of words, unless immediately preceded by some preposition, as *inhabit, reject*, &c. in which case, the reader will be taught hereafter how to write them: and when *x* and *y* are not at the beginning of words, they may be expressed by *ks*, and the dot for the vowel *i* respectively. The properties of these four letters agreeing well with those of the four marks, luckily point out a use for four easy characters, which could not however have been conveniently allotted to any other consonants; and the following appropriation of them, upon trial, is found to be the most commodious, *viz.* the first for *h*, the second for *j*, the third for *x*, and the fourth for *y*.

*K* is a very common consonant; and the frequency of its occurrence will be much increased by its being made so often representative of the rejected *c*, and *ks* of *x*: a character, therefore, which is not only easy to be made, but which will also join readily with all the rest, without running either above or below the line, must be appropriated to it. The horizontal straight line, with the additional twirl, will, for these reasons, be the most commodious. But as the distinguishing the *k* and *q*, at the beginning of words especially, will, in some degree, facilitate the reading; the horizontal straight line with the twirl above is made for *k*, with the twirl below for *q*, when they are initial letters.

In all other cases, these two marks are used promiscuously for *k* or *g*, whenever a more easy, beautiful junction may by that means be obtained; the one joining evidently much better with the characters which are written upwards, the other with those downwards.

But to give a detail of all the reasons for the appropriation of each particular mark to each consonant, would prove tedious. Most of them cannot escape the observation of an attentive practiser as he goes along. It will, therefore, be sufficient to assure the reader, that no pains was spared to adjust the alphabet to the utmost nicety, by such an exact attention to continual trials and amendments as was necessary to ascertain the preference of the disposition of the characters in it to any other that could possibly have been pitched upon amongst that almost infinite variety into which they might have been thrown; and that, if he has the curiosity to make the experiment, he will find, that no change can be made in the allotment of the marks, but what will be attended with considerable disadvantage.

Two marks are allotted to *b*; (see Table of the Alphabet, Plate CL.) The first of these marks is the best when separately formed, but does not join well with the *l* or *r*. For similar reasons, some other of the consonants have more than one mark allotted to them.

One or other of the two marks appointed for *w* is always to be used when it is an initial letter; in other situations we scruple not to express it by a dot in the *o* or *ou* place, writing *pour* for *power*; especially if it joins not well with the preceding consonant, or no great ambiguity arises thereby.

The marks being thus adjusted to the particular consonants which they are to represent, let us see how any precedent, subsequent, or intermediate vowel may be affixed to any of these consonants, as occasion shall require.

In separate letters there is no difficulty, there being five distinguishable places for any given vowel or point, either preceding or following the consonant: reckoning, therefore, the vowels *a*, *e*, *i*, *o*, *u*, according to the established number and sequence, *a* is to be placed at the beginning of the consonant, *e* at the end of the first quarter, *i* at the end of the second quarter, that is the middle, *o* at the end of the third quarter, and *u* at the end of the consonant itself.

In the perpendicular and inclined letters, the vowels which precede are placed upon the left hand; those which follow, upon the right; because we write from left to right; as for example, *at*, *et*, *it*, *ot*, *ut*; *ta*, *te*, *ti*, *to*, *tu*. N<sup>o</sup> 6.

In the horizontal letters, the vowels which precede are placed above; those which follow, below; because we write from top to bottom; as, *as*, *es*, *is*, *os*, *us*; *sa*, *se*, *si*, *so*, *su*. N<sup>o</sup> 7.

In the semicircular letters, the vowels *a*, *e*, *o*, *u*, are placed upon the left hand, the *i* above when they precede, and the contrary when they follow, agreeably to the two foregoing remarks; as, *am*, *em*, *im*, *om*, *um*; *ma*, *me*, *mi*, *mo*, *mu*. N<sup>o</sup> 8.

A vowel between two consonants may be referred to either, and therefore seems to have two places: but in letters which form an angle when joined, this is the case of *i* only; for *a* and *e* can only be placed immediately after the first consonant, *o* and *u* only before the last; left *a* and *e*, if placed before the last, should, in the narrow part of the angle, be confounded with *u* and *o* after the first; as, *rat*, *ret*, *rit*, *rot*, *rut*. N<sup>o</sup> 9.

This twofold place of *i* may be of use in distinguishing,

when thought necessary, the short *i* from the long one, by making it short when placed immediately after the first consonant, long when before the second; as *quit*, *quite*. N<sup>o</sup> 10.

The great difficulty of learning the true pronunciation of our language, occasioned chiefly by our perplexed, various, and confused way of spelling, has been always matter of much complaint with all foreigners who have attempted to learn it. But this absurd irregularity is by far the most remarkable, in the customary management, or rather mismanagement of the vowels. It is hardly possible to give a rule for them, against which the exceptions will not be almost as numerous as the agreeing instances. How frequently do we put two, nay sometimes three vowels, to express the sound of one only? What, for example, has the *e* and *a* to do in the word *beauty*? The short-hand writer, however, is not embarrassed with any of these difficulties. He, totally disregarding the common way of spelling, is to insert only such letters as are pronounced; and must consequently write the word *beauty* thus, *buty*. But the insertion of more vowels than are necessary to the sound is not the only instance of irregularity to be met with;—there being more than five vowel-sounds in our language; and custom, having allotted only five letters to signify them all by, often makes one vowel express two or three different ones, nay, even diphthongs or combinations of vowels. We therefore, taking the advantage which custom in this case affords us, shall extend the power of our dots or points to the same degree: The fairness and propriety of doing this will more fully appear upon a particular examination of all the vowels in their order.

And first, in common writing, the letter *a* has three powers, viz. that of *a*, of *ai* or *ay*, and of *au* or *aw*; as in the words *father*, *fable*, *fall*, or *amen*. *able*, *altar*; which are pronounced all one as if they had been written *father*, *faible*, *faul*, or *amen*, *aible*, *aultar*: so that we are fairly authorized to extend the power of our vowel or point to the same degree in all other instances.

The vowel *e* sometimes expresses singly the sound that two of them are often made for, as in, *he*, *me*, *we*; where its sound is the same as that of two *e*'s; as in *see*, *tree*, *agree*, &c. We are therefore free to use one *e* in this case, whenever it suits our purpose, as well as for *ea*, *ey*, *ei*, *eo*; for of what use is the latter of these vowels in *pea*, *prey*, *heifer*, *people*, but to puzzle children and foreigners?

The same irregularity and confusion is observable in the customary management of the other vowels, *i*, *o*, and *u*; they each of them singly expressing several different sounds, which also are denoted at other times by several different combinations of them. The vowel *i*, for instance, when it is short, is sounded in English as *ee*, agreeable to the pronunciation of it in most foreign languages; when long, it has always the sound of a diphthong, or combination of the two vowel-sounds, (which we might express by the open *a* or *au*, and the short *i* or *ee*;) which sound or diphthong is also sometimes expressed by *oi*, as *fill*, *file*, *soil*, *fin*, *fine*, *join*.

In like manner, the vowel *o* has several different sounds; as in the words *pol*, *pole*. *do*: the sound of the *o* in *pole*, is sometimes expressed by *ow*, as *to sew*; sometimes by *wo*, as *sword*; sometimes by *oa*, as *soal*; its sound in *do*, by *oo*, *wo*, and *ough*, as *too*, *two*, *through*.

And lastly, the sound of *u* (which is always really a diphthong,

thong, expressible by the combination of the two vowel sounds *ee* and *oo*) is denoted in a great variety of ways in our common spelling, viz. by *u, ue, eu, ew, ieu, iew, ugh, eau, you*; as in the words *tune, due, few, adieu, view, hugh, beauty, you*. We are therefore certainly at liberty to represent all these by a point, in the place of the vowel *u*; and thus not only all the single vowels, but all the combinations of them, are expressible by the shortest and easiest of all marks, viz. a dot in the place of the vowel of nearest sound.

We will now proceed to examine what further use we can make of these marks or letters for the purposes of short-hand. And as numeral figures exhibit to us a kind of short-hand with which every one is acquainted, an allusion to them will perhaps explain what we have to say hereupon.

Observe, then, the figures by which the words or numbers, one, five, four, six, are expressed in the Roman characters, which are likewise some of those which we make use of: I, V, IV, VI. Here we see the figure I is considered in three different situations, as standing by itself, close before, and close after another figure: and has accordingly three different powers, of numeration, subtraction, and addition. When it stands by itself, its name and power is one; when it is close to, or belongs to another figure, it loses its name, yet retains something relative to its power, by lessening or increasing that other figure by one; and both together concur to signify but one word or number, vulgarly expressed by the single figure of 4 or 6.

To apply this to short-hand; let the same character |, being our letter *t*, have also its three distinct powers, viz.

First, When it stands by itself, let it express the commonest word or particle in our language the initial consonant of which is a *t*: let the name therefore of this character, for instance, be *the*; a word which we have such perpetual occasion to write.

Secondly, When it is placed close before any other characters, let it stand for the commonest preposition, or leading part of a word, that begins with the same consonant; which in this case will be *trans*.

And thirdly, When close at the end of other marks, let it signify the commonest ending or termination, of which the first (or only) consonant likewise is *t*, viz. *ity*.

From this easy and regular assignment of a threefold power or signification to a consonant, a threefold advantage naturally follows. 1st, By allotting to every mark standing by itself, a name, viz. that of the commonest word or particle of which it is the first, we shall have a number of words, one or other of them perpetually occurring, dispatched by the single characters of the alphabet, which otherwise, when single, would stand for nothing.

2dly, The prepositional part of a word being described by its leading consonant in close situation, but unjoined to the following part of it, secures alike the beauty and the brevity of the characters in many cases wherein it could not otherwise be maintained; and also renders arbitrary marks needless and superfluous; there being no sort of occasion for complicated crotchets where the simple letter determines precisely enough the preposition wanted.

3dly, As it does likewise the termination, by its near approach to the end of characters; when, by the mutual help of each other, they describe a word sufficiently to distinguish it from all others.

Thus, in the instance here alluded to, the same straight

lines, and the same situation of them, by which four different numbers are expressed in numeral short-hand, are those by which we should, in literal short-hand, express occasionally four such words as the letters and similar use of them just hinted at would describe, viz. in the numeral I *one*, V *five*, IV *four*, VI *six*; in the literal I *the*, V *fr*, IV *transfr*, VI *frity*.

For though the initial and final power of a consonant could not, indeed, be expressed in this manner by a bad alphabet, and a piecemeal huddling of its characters up and down, to denote the vowel's places; yet, in a well contrived one, where consonants of shorter words fall easily, by one continued stroke, into each other, a break in those of longer ones may be so descriptive of their initial or final syllables, as often to express the whole with a conciseness which many shorter words may not admit of. Every consonant, then, may denote, according to its single, previous, or final situation, a common word, preposition, or termination.

But the horizontal straight line may be made from the top, middle, or bottom of the said horizontal space, that is, from the place of *a, i, or u*: since, then, these vowels before an *s* make the three common words *as, is, us*, it may as well stand for them all, in their several places, after this manner, *as, is, us*. N<sup>o</sup> 10.

*Trans* is the only common preposition beginning with *t*: but there are three common ones that begin with *s*, viz. *super, circum*, (or, as we should write it according to nature, *sircum*) and *sub*, which the horizontal straight line may also stand for, at the top, middle, and bottom of the line: *circum* in the middle, because of its first vowel *i*: but if, for the like reason, *super* and *sub* were both written at the bottom, it might occasion an ambiguity; therefore we make *super* over *circum*, and *sub* under it, because (in Latin) they signify *over* and *under*.

Again, the commonest termination in our language is *son* or *tion*; in pronunciation, *soon*. There are a thousand words, all in general borrowed from the Latin, which end in this manner, the greatest part of them of common use. Now let the letter *s* be drawn near to the end of any of these words, from the place of the vowel preceding the *son* or *tion*, and it will serve for any three final syllables whatever of the numerous words that afford this termination.

A few instances may suffice; as, *oration, repletion, attrition, promotion, effusion*, N<sup>o</sup> 11. And also, when one or more consonants intervene between the vowel and termination *tion* or *son*, they are, by the rule, to be expressed by the *s*, drawn from the vowel's place; as, *attraction, attention, affliction, adoption, eruption*, N<sup>o</sup> 12.

All the rest of the consonants are to be considered in the same threefold light, viz. as standing by themselves, as placed close before, or close after other marks; and must, accordingly, have a power of denoting some common word, preposition, or termination, in which that consonant is found. This is the general rule; but in practice there are few prepositions and terminations necessary or useful besides those set down in the alphabetical table. This rule is very convenient in some cases; as where the consonants of which the word is composed join not well together, or cannot be kept within the parallels; for instance, in *behold, inhabit, deposit*, N<sup>o</sup> 13. and affords a great contraction in others, as *underwritten, distinction, direction*, N<sup>o</sup> 14. But here it is to be observed, that, in placing the termination, regard

is to be had to the vowel's place with respect to the line, and not to its place after the last consonant, (except that happens to be one or other of the three horizontal characters *s*, *k*, or *q*.) as in the above word *direction*: the *s* is drawn from the *e*'s place in the line, but it is in the *o*'s place with respect to the last consonant *r*, which appears evidently to have begun at the bottom of the line. But when *s*, *k*, or *q*, immediately precede the termination, regard is then to be had to the vowel's place after the letter: as *assumption* *affertion*, (N<sup>o</sup> 15. first and second examples.) The plural number of the termination is denoted by adding a little *s*; as *verities*, *distinctions*, (*ibid.* third and fourth examples.)

Before the learner begins to write by the preceding alphabet, it may not be improper to premise a few observations upon the form and respective proportion of the letters, and the ways of joining the curved ones with the most ease and elegance.

First, All the perpendicular and inclined letters (that is, all the letters except *s*, *k*, *q*, *m*, *n*, *ch*, and *g*.) are made to touch two parallel lines, the distance of which is measured by the perpendicular straight line *t*, as in N<sup>o</sup> 16.; but, however, these letters are sometimes, for greater convenience, made of half-size, and two of them included between the parallels, as in the seventh and eighth examples, N<sup>o</sup> 16.

The letters *m*, *n*, *ch*, and *g*, are semicircles; the diameter of which is the *s*, and their radius or height is rather more than one third part of the *t*.

The letters formed from the three straight lines *t*, *r*, and *f*, are segments of larger circles, whose chords are the letters *t*, *r*, and *f*, respectively.

It must be observed, however, that it is not necessary, nor indeed scarce possible, that these proportions should be exactly kept, especially in quick writing; but they are given here, because the nearer they are kept to, the more beautiful the writing appears.

Secondly, When *m* and *n* are joined together, they are not each of them to be made complete; but a part is to be cut off from each of them; and in the same manner the inclined letters, when joined with *m* or *n*, are not made complete, but, running into one another, lose each a part, as N<sup>o</sup> 17. So the rest of the curve line letters, when joined together, are made to run into one another smoothly; avoiding, by this means, that stopping of the pen which the making of any angle necessarily occasions; as for instance *mp* is not written, as in the first example N<sup>o</sup> 18. but as in the second, part of the curved line being in common both to the *m* and *p*.

Thirdly, The twirl is always made at the beginning, never at the end of any letter; whenever, therefore, the six last characters (N<sup>o</sup> 18.) occur, they must be supposed to have been begun from the bottom of the line.—The general rule is, That all perpendicular and inclined letters are to be begun from the top, and drawn downwards; but in all instances, in which the inclined letters (N<sup>o</sup> 19.) will join better with the preceding or following marks if drawn upwards, they must be drawn in that direction, as in these words, N<sup>o</sup> 20.

Fourthly, The initial or final vowels (the *e* mute excepted) are generally expressed, and the middle ones omitted, except in cases where there are many words consisting of the same consonants which might be liable to be taken for one another. But all words which have one consonant only (except those in the table of the alphabet, which are

expressed by the letter alone) must always have the proper vowel point expressed, as *by*, *to*, &c. because these little words are, as it were, the keys of the sentences in which they are found.

Fifthly, Few monosyllables beginning with a vowel are immediately followed with either *h* or *w*; for which reason, these characters, having a point before them, denote *ht* and *wt* respectively, with the proper vowel between them; as *hat*, *het*, *hit*, *hot*, *hut*, and *wat*, *wet*, *wit*, *wot*, *wut*, N<sup>o</sup> 21.

Sixthly, As the horizontal letters *s*, *k*, *q*, and the curved ones *m*, *n*, *ch*, and *g*, may be written at the top, or bottom, or any part of the line, the vowel following them may be expressed by their situation between the parallels; as *fan*, *sun*, *man*, *mun* N<sup>o</sup> 22.

Seventhly, The first mark for the *th* in the table, not joining well with the mark for *r*, which, however, is very frequently combined with it; and the other *th*, being, by reason of our customary method of leaving the letters the contrary way in common writing, not so readily made; *t* may be put for *th*, when the adjoining letter is of half size only, as *thr*, *rth*, *thm*, *thn*, *ths*, N<sup>o</sup> 23. In other cases, a letter of half size signifies that the adjoining one is to be resolved into two letters as *trr*, in the first example N<sup>o</sup> 24.; for here the *r* being twice as long in proportion to the *t* as it ought to have been had only one *r* been designed, shows, that in this case the *r* of double length denotes *rr*: but, in the second example, the last character does not signify *ll*; for it cannot be resolved into *ll*; but it may into *lf*; for if you divide the last character into two halves, the lower is our mark for *f*: in like manner, the third example is *ftt*.—When there is no other consonant to be joined to the inclined letters *f* or *r*, the lengthening of them by a greater inclination than usual denotes that they are to be resolved into two letters *rr*, *ff*, or *vv*, *fv*, or *vf*; as in the three first examples, N<sup>o</sup> 25. *error*, *five*, *coffee*: but when two *t*'s form a word, as for example the word *taught*, or, as we should spell it, *taut*, this expedient cannot be used, without going either above or below the line, which is not to be done upon any account whatsoever. In this case a little break must be made in the *t*, to show that there are two *t*'s, N<sup>o</sup> 25. This must be confessed to be not altogether regular, and conformable to our rules of joining the letters; and, had many instances occurred, their frequency would have furnished a just objection against our alphabet; but on the contrary, the repetition of the *t* forming fewer words than that of the other consonants, was one reason of appropriating the perpendicular line to the *t*, the word *taught* being the only one that often occurs in practice.

Eighthly, In some few instances, where a letter joins not well with the preceding one, as the *g* with any drawn downwards, the *ch* with any upwards, and the *j* with neither; we scruple not to borrow the opposite one, or some other of nearly the same sound, in its stead; writing instead of *voyage*, *voyach*; *figure*, for *figure*; *church*, for *church*; *majesty*, for *majesty*; N<sup>o</sup> 26. And when *n* happens to be at the bottom of the line, and is followed by *d*; for the sake of easy joining, we write *p* instead of the *d*, as in the first example N<sup>o</sup> 27. *fnp* for *fn d*; and few words in our language ending in *np*, this can cause little ambiguity.

Ninthly, *cm* and *cn* occurring very frequently, for the sake of dispatch we shorten the marks for *k* and *q*, when followed by *m* or *n*, as in the third and fifth examples,

N<sup>o</sup> 27. These cannot be mistaken for *ch* and *g*, the twirl being on the contrary side.

Tenthly, The first mark, N<sup>o</sup> 28. placed close after a word, denotes, that there is one syllable still wanting to complete the word, and *ing* being a very common final syllable, it is often so denoted; as, *being, writing*, No. 28.

Eleventhly, A point standing by itself has a power, as well as the consonant marks, of representing a common word. At the top of the line, it signifies the particle *a*; as, *a man*: in the middle *I*, or *eye*; as, *I will, his eye*: in the *o*'s place *o*; as, *O Lord*: at the bottom *you*; as, *you will*. N<sup>o</sup> 29.

Twelfthly, The common way of writing numbers being very compendious we generally use it when numbers occur. The comma, as it does not resemble any of our short-hand marks, may always be used; but when a full stop is thought necessary, the small circle after the examples, No. 29, may be used instead of the point.

To these rules it may be proper to add a few observations. In writing words (as before observed) we join all the consonants, that are wanted, together; to which, if they suffice to distinguish a word, it is needless to add any of its vowels. As for instance, to write the word *strife*, we join the four consonants of which it is composed into one continued mark or figure comprised within the due limits, as in N<sup>o</sup> 30. first example: for if, without regarding the limits, we should make it as in example second, the letters would be the same indeed; but the direction in this, and all similar cases, is evidently more incommodious. When, therefore, there are different ways of joining the same letters together, we must accustom ourselves to the best, or most lineal. The sameness of the entire figure, as well as that of its composing letters, is worth the writer's while to maintain; and also facilitates mutual reading between the fellow-practisers of the same method. There is a kind of mechanism in the case, by which the attention, being less fatigued with any deviations of unusual appearance, easily apprehends the meaning of that which is more conformable to a standard.

Though the letters *strif* are abundantly descriptive of the word *strife*; yet if any one pleases, he may add the point for the vowel *i*, (as in the example, N<sup>o</sup> 30.) to suggest the word to him at first, until he can read it readily without that assistance.

In single words, the chief difficulty is, to unlearn the unnatural and perplexed method of spelling to which we have been long habituated. In this word *practice*, for example, the consonant *c* is pronounced as *k* in the first syllable, and as *f* in the second, and the vowel *e* has no pronunciation at all. But, being used to these difficulties, it is now become one to know the word by its true and genuine spelling according to our short-hand alphabet, viz *praktis*.

*It may highly perplex a careless writer of new characters, to decypher the true sense thereof; though it should be easy enough to know it, by a little application and practice. But what child would not sooner learn to read this same sentence, if, after being taught the use of his alphabet, he should have it thus written?—It ma bili perpleks a karkles riter of nu karkters, to deffiser the tru sens thereof; tho it shud be est enuf to kno it, bi a littl aplikashon and praktis.*

Instead, therefore, of scrupling to return from such customary rules as children are first initiated in, to a more just and alphabetical way of writing short-hand, men may easily

be taught, when ripened into some acquaintance with their mother-tongue, to reverse the liberties perpetually taken in long-hand; that is, instead of employing more letters than are precisely necessary to express the sound of words, they may make use of fewer, not only dismissing such as are needless to the sound, but such also as may be omitted, and yet leave the sense of the words easily discoverable. If they can tell what is wanting, it is all one as if it was there; the less expression there is, so much the better for the purposes of brevity, which justifies the greatest omissions, provided what is left be intelligible.

And though the omission of the vowels in the middle of words may, for a while at the first, make it difficult for a learner to read even his own writing without hesitation; yet that difficulty will certainly vanish, in proportion as the short-hand marks become familiar to him, as it arises, not so much from that omission, as from the strange and unusual appearances which the characters make to his eye, and which, for that reason, do not suggest to him the consonants, for which they stand, so immediately, but that the attention of the mind is necessarily taken up in recollecting them one by one; whereas, did they appear so familiar and well known to him as all to be apprehended in one view, he would soon discover the word, though all the middle vowels were left out. If any one doubts this, he may soon convince himself, by writing in the common long-hand exactly the same letters which he had written before in the short-hand characters; and if he can read it with ease when so transcribed, he may be certain that a little custom will make the reading of short-hand every whit as easy to him.

And now, the way being sufficiently cleared before him, the learner, after he has, by repeated trials, acquired a facility of forming, with tolerable exactness, all the letters of the alphabet separately, and of remembering what particular consonant each of them represents, may proceed to join two or three of the marks together; writing at first only short words, and frequently trying different ways of joining the marks, in order to discover the best, and most elegant. Several of them being formed almost as easily upwards as downwards, he will find it convenient sometimes to begin from the top, sometimes from the bottom of the line, according to the nature of the mark which follows; and when two marks, which admit of being written downwards only, come together, the line must be divided between them, making each of them half the usual depth, as in examples first and second, N<sup>o</sup> 31. and, in some very rare instances, he will be forced to make them three deep, as *stupid*, (example third;) except he chuses to make use of the expedient of borrowing the *b*, a letter not very different in sound, writing *stupid* for *stupid*, as in the fourth example.

That the learner may proceed with the greater ease and certainty, we have given specimens of writing according to the above rules (Plates CLI, CLII.) for his imitation. He ought to make himself fully master of the first specimen, by reading and copying it over and over with great care, until it becomes quite natural and familiar to him, before he proceeds to the second; and he ought in the same manner to make himself thoroughly acquainted with the second, before he proceeds to the third. Thus moving with slow, but sure steps, he will in a very few days find, that every difficulty has disappeared, and that nothing remains but to practise till the habit is acquired. If he has the curiosity to compare the number of strokes and dots in his first speci-

men in short-hand, which is the Lord's prayer, with those used when it is wrote in the common way, he will find, that the former contains only about 150, while the latter con-

tains near six times that number; which shews how much time and labour may be saved, even by the few simple rules already given.

## P A R T II.

**A**N alphabet, formed upon the most just and natural plan, by which, with the help of a few general rules, all the words of the language to which it is particularly adapted, may be easily, neatly, and speedily written, will not be sufficient to satisfy the expectations of an inquisitive reader; who must be sensible, that however complete the alphabet may be, yet many compendious applications of it may be obtained by a proper inquiry into the nature of our language, and the abbreviations which it admits of. He will not be satisfied with being taught only how to express all the letters of a word by the shortest and easiest strokes, but will also require further instruction how to describe intelligibly words and sentences by as few of those strokes as possible. To investigate, from a few things given, many which are omitted, will be found no unpleasant nor unprofitable exercise of the learner's sagacity; and if the few be properly given, the sense of the passage, and a due attention to the idiom of our language, will render the discovery of the omissions more certain, and also less difficult, than the unexperienced can easily imagine.—Without some such rules of abbreviation, one end of short-hand, that of following a speaker, would scarcely be attainable.

Before the invention of the art of printing, the tediousness of writing all the words at full length put the copiers of books upon forming many ways of abbreviating them, as appears in all manuscripts. In those of the New Testament we find many principal words described by their initial and final letters only, with a dash over them. In Latin manuscripts, those terminations, by which the relations of words to one another are in that language usually expressed, were generally omitted: nor was there any need of writing them at length; for the principal word being given, of which the rest were governed in case, gender, and number, any reader who understood that language could easily supply those omissions. Our language, generally expressing those relations by little particles, does not indeed afford that particular mode of abbreviation. Upon a careful examination, however, it will be found capable of furnishing many others as useful and extensive.

But it will be proper, before we proceed further in this art of abbreviation, to advertise the learner, who is apt to be too eager to push forward, not to embarrass himself with it, till, by a competent practice of writing according to the rules laid down in the first part, he is become so well acquainted with the characters, as to be able to write and read them with as much ease as his own common hand. The best way to learn any art is to proceed by degrees, not venturing upon a second step before the first is perfectly mastered. And it is evident, that this method of proceeding is, on this occasion, particularly necessary: for though, in many sentences, the sense, and the particular construction of the words, may plainly enough point out such of them, as are described with unusual brevity; yet how shall an unpractised learner, unable to embrace in one view the words denoted by the preceding and following marks, determine what the intermediate contracted ones must needs be? But,

if he will have patience to abstain from this second part, until he can write readily, and read without hesitation whatever is written, according to the rules of the first, he may rest assured that he will meet with little more difficulty in reading words contracted than he did in those written more at length, provided that the rules of abbreviation be duly attended to. But, if the reader expects that we are to give him every particular manner of abbreviation which can possibly be invented, he will be disappointed. The principal and most useful rules are given; and it is left to the sagacity of the practiser, by observing the nature of these, and proceeding upon the same principles, to make such further advances as his occasions may require. It would be vain to pretend to have exhausted a subject which is as extensive as the language itself in which we write; and consequently may be carried further and further by every one, in proportion to his skill in the language, and his knowledge of the subject treated upon.

The learner has been already taught how to write all the consonants of any word by one continued mark, those words only excepted which may be more briefly described by the help of prepositions and terminations. He may now advance a step further, and join together such short words as are either represented by the letters of the alphabet alone; or such as, by their frequent occurrence, are become so familiar, as to be readily known, though denoted by their first consonants only. This will be found a greater saving of time than can easily be imagined; and must therefore, when dispatch is required, be done in all instances in which they may be joined neatly and without ambiguity.

**RULE I.** The different times and modes of the verbs are generally expressed, in the English language, by the help of other verbs, for that reason called auxiliary; as, *will, shall, have, had, can, could, may, must, be, &c.* These must, upon that account, occur very frequently; and, being signified by their first consonant, they may be joined to one another; as, *can be, will be, have or has been, to be, ought to be, must be,* Plate CLIII N<sup>o</sup> 1. and when the negative particle *not* intervenes, it may be denoted by its first consonant, and be joined with them; as, *cannot be, N<sup>o</sup> 2. will not be, have not been, not to be, ought not to be, N<sup>o</sup> 3.* When these joinings are, by a little practice, become easy to the learner, he may proceed further, and join the preceding pronouns to these auxiliary verbs; as, *he must be, he cannot be, N<sup>o</sup> 4.* This can occasion no ambiguity: for though he was taught in his alphabet, that these two marks (N<sup>o</sup> 5.) denoted, the former *have* and the latter *had*; yet, when placed immediately before *must* and *can*, their situation shows that they cannot, in that case, signify *have* and *had*, those auxiliaries never admitting of such an arrangement. And further, as *w* and *h* are often dropt in common speech and writing, as *be'll* for *he will*, *we've* for *we have*: so they may, for the sake of joining, be omitted in short-hand; as, *he will, he will not be, they have been.* N<sup>o</sup> 6.

**RULE II.** The learner was taught in the first part, That

1	-		/	\
2	∞	∞	//	\\
3	∞	∞	∞	∞
4	∞	∞		
5	∞	∞	∞	∞
6	∞	∞	∞	∞
7	∞	∞	∞	∞
8	∞	∞	∞	∞
9	∞	∞	∞	∞
10	∞	∞	∞	∞
11	∞	∞	∞	∞
12	∞	∞	∞	∞
13	∞	∞	∞	∞
14	∞	∞	∞	∞
15	∞	∞	∞	∞
16	∞	∞	∞	∞
17	∞	∞	∞	∞
18	∞	∞	∞	∞
19	∞	∞	∞	∞
20	∞	∞	∞	∞
21	∞	∞	∞	∞
22	∞	∞	∞	∞
23	∞	∞	∞	∞
24	∞	∞	∞	∞
25	∞	∞	∞	∞
26	∞	∞	∞	∞
27	∞	∞	∞	∞
28	∞	∞	∞	∞
29	∞	∞	∞	∞
30	∞	∞	∞	∞
31	∞	∞	∞	∞

*A Table containing the Alphabet, the common words which the letters stand for, the Prepositions and Terminations.*

	Names	Prepositions	Terminations
1)	b be but	be	ble or able
(	d and	de or dis	er
\	f of	fer	iff
∞	g against		
∞	h have had		
∞	j Judge Just		
∞	k can	can or com	ical
∞	could		
∞	l all		
∞	m amongst	mis	ment
∞	(an	ante or an	
∞	n in	inter or in	neps
∞	(under	under	
∞	p upon	pre per pro	
∞	q question		
∞	r or	re	ary
∞	(as	super	a)
∞	is	circum	e)
∞	(as	sub	i)
∞	t the	trans	u)
∞	w will would	with	tion or sion
∞	x except exercise	ex or extra	ity
∞	y yet		ward
∞	ch which		
∞	sh shall should		ship
∞	th that		



The Lord's Prayer. I V V.

Handwritten text in a cursive script, likely representing the Lord's Prayer in a shorthand or cipher system.

The first Psalm. I V V.

Handwritten text in a cursive script, likely representing the first Psalm in a shorthand or cipher system.

The first Collect. I V V.

Handwritten text in a cursive script, likely representing the first Collect in a shorthand or cipher system.

Spectator Vol. 8<sup>th</sup>. No. 586

Handwritten text in a cursive script, likely representing the beginning of an article or letter in a shorthand or cipher system.

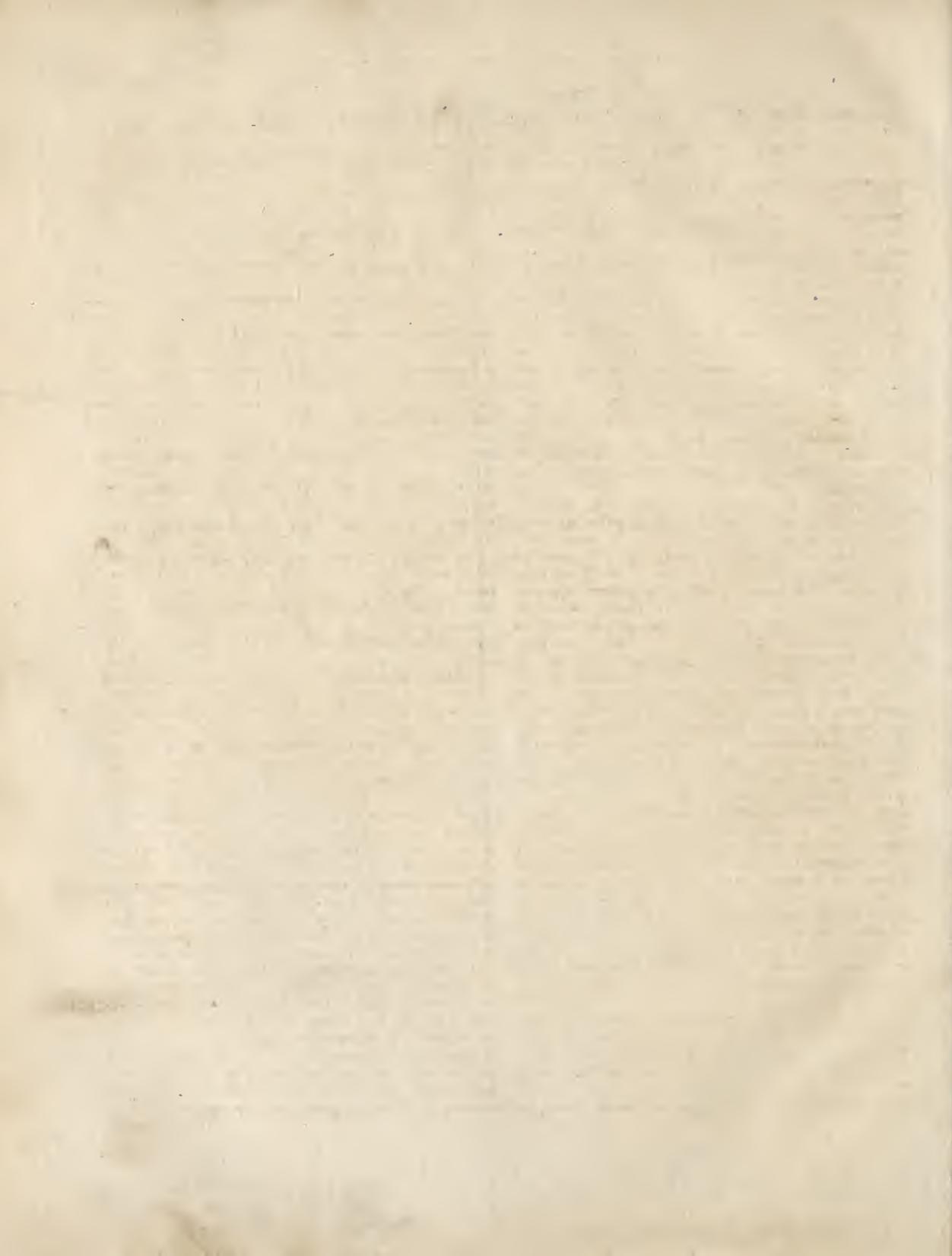
7,

Pythagoras

Large block of handwritten text in a cursive script, likely representing the main body of an article or letter in a shorthand or cipher system.







in writing all the consonants of which any word was composed, the beginnings of the marks which follow must always be joined to the ends of those which precede them: Whenever, therefore, they are joined in any other manner, it is to denote, that each particular mark signifies a whole word, and not a single letter: as for example, the particular way of joining the letters in the first example, N<sup>o</sup> 7. is a sufficient indication that they were not intended to represent a word consisting of those two consonants, but two words; and the *n* in the middle of the line standing for *in*, and the *t* for *the*, *in the* may be written as in that example. So again, the second example, N<sup>o</sup> 7. denotes two words; and the *s* being drawn from the place of the vowel *i*, shows the latter of them to be *is*: and though the straight perpendicular line usually represents the article *the*, yet, in that situation, it cannot possibly do so; for that article can never come immediately before a verb, but the pronouns very frequently do. *It is* may therefore be very commodiously written as in that second example; and *it is not to be*, as *it is*, *since it is*, may be written as in N<sup>o</sup> 8. and by dropping *uv*, as before, we may write *it'as*, for *it was*, *it was not to be*; *it'ere to be*, for *it were to be*; *it seems to be*; as in N<sup>o</sup> 9. for the *s* being drawn from the place of *e*, shows that it must be either *it es—to be*, or *it se—to be*; and *it seems to be* is so very common a phrase, that it will not give much trouble to the reader, though written in this concise manner.

RULE III. Points being the shortest of all marks, it would argue a great want of æconomy, as well as invention, not to make all the use of them that can be made consistently with the regularity of our system. The power of representing prepositions and terminations, which was allotted to the consonant marks, could not be given to the points: for, in that situation, they stand for the vowels; and all the distinguishable places, both before and after the consonant marks, are already taken up by the five vowels: but a point placed directly over or under the beginning or end of any of those marks, has as yet had no signification annexed to it. As for instance, in the second example, N<sup>o</sup> 10. the point being so placed, that if the *t* was produced, it would pass through it, is very distinguishable from all the vowels. All derivative substantives may therefore be very conveniently represented by making the point stand for the substantive derived from the word at the end of which it is placed; so the two examples, N<sup>o</sup> 10. signify *forget*, *forgetfulness*.—But as there are derivative adjectives and adverbs as well as substantives, it will be a great compendium to represent them also by points, distinguishable, by their situation, both from the substantive and the vowel points; which may be done by placing them in a line, which, if produced, would pass through the substantive-point and would also be perpendicular to the last consonant mark; and by making one placed before the substantive-point to signify the adjective, one after it to signify the adverb: As, *forgetful*, *forgetfulness*, *forgetfully*, N<sup>o</sup> 11.; *reasonable*, *reasonableness*, *reasonably*, N<sup>o</sup> 12.; *sufficient*, *sufficiency*, *sufficiently*, N<sup>o</sup> 13.

RULE IV. Although the above described mode of abbreviation is very extensive, there being in our language a great number of long words derived from short ones; yet it is far from being the only use which may be made of these adjective, substantive, and adverb points. In all discourses whatever, there must be some principal words, which, ei-

ther by their more particular relation to the subject, or frequent occurrence, will be easily discoverable, however concisely written. If such words begin with a consonant, the first letter, if not the first vowel and consonant, with the adjective, substantive, or adverb point annexed, will suggest them immediately; and therefore will be, though a brief, yet a sufficient description of them. As for instance, if the following passage be transcribed out of a discourse upon the folly of worldly-mindedness, in common long-hand, after this manner, *Our blessed L——, both by his preaching and ex——, has fully shown us the vanity and folly of seeking for solid and lasting b—— in the possession of any of the goods of this present w——*; every one must immediately see, that the words, described by their initial letters, are too plainly pointed out by the nature of the subject, and their accompanying epithets, to leave any room for doubt or mistake. In following a speaker, the same description of them in short-hand must therefore be allowed to be sufficient. But it may not be amiss to give another instance or two, with the short-hand characters for the abbreviated words; as, *Life and IMMORTALITY are brought to light by the GOSPEL*; or again, *The RESURRECTION of the dead, and a future state of REWARDS and PUNISHMENTS, are plainly and positively taught in the gospel*. In these instances, *immortality*, *gospel*, *resurrection*, *rewards*, and *punishments*, may be wrote as in N<sup>o</sup> 14. So in writing after pleaders, who frequently use the expression *with submission to your Lordship*, the words *submission* and *Lordship* may be wrote as in the first and second examples, N<sup>o</sup> 15. and if the adjective *humble* be joined to *submission*, it may be denoted by its first consonant, and be joined to the substantive; and the words *humble submission* may be written as in the third example. This will be found a very useful compendium; for there are many substantives to which some particular adjectives are usually joined; as, *human nature*, *Christian religion*, *natural philosophy*, &c. Whenever, therefore, the subject treated of will lead to the discovery of the substantive, though denoted only by its first consonant, it will, at the same time, discover the adjoined adjective. This method may indeed appear, at first sight, to clash with the rule about derivative substantives; but it will seldom happen that the two consonants will compose any word from which another can be derived; or if it should, it would scarcely ever be such a one as would agree with the context.

It will appear evidently, upon a little consideration of the nature of this mode of abbreviation, that no limits can be set to it; but that it may be more or less frequently used, in proportion to the knowledge, skill, and readiness of the writer, which will enable him to judge in what instances such liberties may be taken without occasioning ambiguity. And every writer may accustom himself to mark such words as most frequently occur in his own particular profession, by the initial letters, with the substantive, adjective, and adverb points respectively, which, through custom, will easily suggest those words to him at first sight. But it must not be understood that those marks necessarily imply those words, and no other: They may stand for any other beginning with the same letters, which the sense of the passages requires. It cannot therefore be expected that a list of them should be given here; but the following are some of those which are most commonly used: as, *God*, *happiness*, *heaven*, *Lord*, *always*, N<sup>o</sup> 16.; *altogether*, *occasion*, *accordingly*, N<sup>o</sup> 17.; *notwithstanding*, *opinion*, *perhaps*, *religions*.

religion, N<sup>o</sup> 18.; *subject, together, world*, N<sup>o</sup> 19.

RULE V. An attention to that property of the English language, of expressing the different connections, and relations of one thing to another, for the most part, by prepositions, which the Greek and Latin, and some modern languages, do by varying the terminations of the substantives, will point out a further application of the dot to the purposes of abbreviation: for as, in the Latin manuscripts, the root or body of the word being given, there was no necessity of writing the various terminations of the cases, since any reader who understood that language could himself supply the particular termination which the case required; so, in English, if the two related substantives be such as may be readily known, even when represented by their first consonants only, they may be joined together, placing a dot at the point of their junction, to show that they are both substantives; and the preposition connecting them may be omitted, for it may as certainly and as readily be supplied by the reader as the cases in Latin before mentioned. This consideration will therefore dictate the following rule, *viz.* That a dot placed at the point of concurrence of two consonant marks, as in N<sup>o</sup> 20. denotes two substantives, of which those marks are the first consonants; and also that the latter is governed of, or connected to, the former, by some preposition which is omitted.

As for example, in this sentence, *The sum or substance of all the commandments is contained in the two following, viz. the LOVE OF GOD, and the love of our neighbour*; the words *love of God* may be wrote as in the last example: for as the particular situation of the dot denotes that both *L* and *G* are substantives, the article *the* before the first points out plainly enough the omitted preposition *of*; and the least degree of attention to the words which precede and follow the contracted mark will discover that it must be the *love of God*.

Or again, *The LOVE OF MONEY is the root of all evil; or, Seek ye first the KINGDOM OF GOD, and his righteousness*: these words *love of money*, and these other words *kingdom of God*, may be wrote as in N<sup>o</sup> 21.

The articles *a* or *the*, in this and in many of the following ways of abbreviation, may, for the sake of joining, be omitted, as in the following sentence, *Since the light of the gospel has shone upon the world, &c. the light of the gospel* may be written as in N<sup>o</sup> 20.

And further, though an adjective should precede either of the substantives, yet they may all three be represented by their first consonants joined together, with the dot always placed at the end of the first substantive. No difficulty can ever arise in distinguishing the adjective from the substantives. For, in the following sentence, *The great goodness of God is manifest in all his dealings with his creatures*; if these words, *great goodness of God*, be written as in N<sup>o</sup> 22. the dot placed at the end of the second mark shows that it must be the first substantive, the third must therefore denote the latter substantive, and the first consequently the adjective. In like manner, in the following sentence, *His Majesty the King of Great Britain*, the words *King of Great Britain* may be wrote as in the first example, N<sup>o</sup> 23. for the dot being placed at the end of the first mark, it is evident that the first must be a substantive; and a little attention to the usual arrangement of words in the English language suggests that the second must be an adjective, as adjectives generally precede the substantives to which they are related: there is therefore as much given as if it had been written in long-

hand thus, *His Majesty, the K— of G— B—*; which, in a discourse concerning him, would be sufficient to discover that the contracted words must be *King of Great Britain*.

If each of the substantives have an adjective joined to them, there can be no difficulty for the first and third must be adjectives, except in some rare instances in which the common order is sometimes changed. and the last adjective is put after its substantive, as in this, *the great goodness of God Almighty*: in such cases, either the last adjective must be separated from the rest of the mark; or, if joined, it must have the adjective dot annexed; and *the great goodness of God Almighty* may be written as in the second example, N<sup>o</sup> 23.

This relation of substantives, which is expressed in Latin by the genitive case, in English by the preposition *of*, is by far the most common: but the rule is more extensive, and serves to express two substantives connected by any preposition whatsoever, as *for, in, with, after, &c.* provided that the context, or any particular words of the sentence, easily indicate not only the two substantives which are denoted by their first consonants, but also the preposition which ought to be inserted. As, for example, in this sentence, *Happy is it for us, if, convinced by experience of the vanity of putting our trust in man, we place all our confidence in God*, the three last words may be expressed as in the first example, N<sup>o</sup> 24. For the context plainly points out the two substantives; and the verb *place* marks evidently, that the omitted preposition cannot be *of*, but must be *in*.

In this sentence, *Our holy religion absolutely forbids all instances of revenge, our Saviour expressly commanding his disciples to return good for evil;—good for evil* may be written as in the second example; for the verb *return* shows plainly that it cannot be *good of evil*, but must be *good for evil*. It may, perhaps, be objected here, that *v* is not the first letter of the word *evil*; but it must be observed, that the words of the rule are, That the dot denotes two substantives, of which those marks are the first consonants, not the first letters; and a word may sometimes be so pointed out by others which accompany it, as to be easily discoverable, though the initial vowel be omitted.

It may not be improper to add another example or two for the better understanding of this rule; as thus, *In this present state there is no such thing to be met with as pure unmixed pleasure or pain, good or evil; here below all things are mixed, pleasure with pain, good with evil*. The latter part of the sentence, *pleasure with pain, good with evil*, may be wrote as in the two first marks N<sup>o</sup> 25 for the word *mixed* requiring the preposition *with* after it, shows, that it cannot be *p— of p—, g— of v—*, but must be *p— with p—, g— with v—*.

Or, *He is now become quite blind, he cannot even distinguish light from darkness*. The last three words may be wrote as in the third mark, N<sup>o</sup> 25.

Or again, *If we consider, that without health we cannot enjoy any of those pleasures which riches can procure; what man, that estimates things according to their reality, rather than their appearance, would not prefer HEALTH to RICHES: or thus, if he had it in his option, would not rather abuse HEALTH THAN RICHES; or, would not abuse HEALTH before RICHES*. The three several expressions will be easily distinguished, though wrote all in the same manner, N<sup>o</sup> 26.

RULE VI. The substantive point, placed before a single consonant

consonant mark, denotes, that the substantive represented by it is to be repeated, with some intervening preposition, as *after, to, by*; as for example, *day after day, time to time*, N<sup>o</sup> 27.

RULE VII. The substantive, adjective, or adverb point, placed before two or more consonant marks joined together, denotes two or more substantives, adjectives, or adverbs respectively, of which those marks are the first consonants, and also that they are connected by a conjunction.

As for example, *Our blessed LORD AND SAVIOUR Jesus Christ, by his DEATH and PASSION, made a sufficient SATISFACTION AND ATONEMENT for the sins of the whole world;*—*Lord and Saviour, death and passion, satisfaction and atonement*, being wrote as in N<sup>o</sup> 28.

Or further, *The precepts both of NATURAL AND REVEALED religion forbid us to do our neighbours any injury*; example first, N<sup>o</sup> 29. Here the point shows, that both *n* and *r* are adjectives; and the word *religion*, to which they are connected, will immediately suggest the words *natural and revealed*.

Or, to add one other instance, *What doth the Lord thy God require of thee, but to live SOBERLY, RIGHTEOUSLY, AND GODLY, in this present world?* example second, N<sup>o</sup> 29. Here it appears, by the prefixed point, that *s, r, and g*, must all be adverbs, and consequently that there is nearly as much expressed as if the same sentence had been written in long-hand after this manner, viz. *What doth the Lord thy God require of thee, but to live s—ly, r—ly, and g—ly in this present world?* which surely would give very little trouble to fill up with the words *soberly, righteously, and godly*.

Thus any series of substantives, adjectives, or adverbs, may be expressed by their first consonants joined together with the proper point prefixed. But we must not indulge ourselves in doing this at all adventures. It is only to be done in such instances, wherein the commonness of the phrase, or the nature of the subject, points out the words signified by those letters; or when the words, so briefly described, are such, that no other can be inserted in their stead consistently with the sense of the passage.

When great dispatch is required, as in the case of following a speaker, all omissions are allowable, which can afterwards be supplied by a careful attention to the idiom of the language, and to the connection of the contracted words with those which precede or follow them. And it may not be improper to observe, that greater or less liberties of contracting may be taken, in proportion as the speaker is more or less accurate in his language. For it is certain, that any contractions, where the style is clear and regular, may be more easily decyphered, than where it is confused and embarrassed. It may happen, indeed, sometimes, that the words signified by such contractions will not occur at first sight; but a little thought will discover them; and the reader will find, that an attention of this sort will very agreeably and insensibly lead him into a more perfect knowledge of the idiom of his own language.

RULE VIII. Many long words may be, and frequently are, expressed in common writing by their first syllable only, with a mark to shew that something is wanting, as *mult—* for *multitude*, *cor—* for *correspondence*. So in short-hand, long words, especially those in which the marks for

the consonants will not join neatly, may be denoted by their first syllable, with as many points annexed as there are syllables wanting; as, *multitude, correspondence\**, N<sup>o</sup> 30. And when great dispatch is required, the points may be omitted, especially if the words do not begin with prepositions; as, *signification, difficulty, negligence*, N<sup>o</sup> 31.

RULE IX. The power given to the consonant-marks of representing prepositions and terminations, will enable us to write great numbers of long words after a very expeditious manner: for words beginning with prepositions may be denoted by their respective prepositions, together with the next consonant and vowel; and oftentimes with the next consonant only, adding to it the substantive, adjective, or adverb point, when necessary. As for instance, the first example, N<sup>o</sup> 32 expresses a word beginning with the two syllables *de-li*; and though there are many words which begin with those syllables, as *deliberate, deliver, delicious*, &c. yet if such a sentence as the following were to be written thus, *He was not hasty in his resolution, but took time to deli—* about it, the word *deliberate* would immediately occur to every one.

The trouble of inserting the vowel may, in many instances, be saved, by beginning the consonant from that point after the preposition in which that vowel should be placed; as in example second, N<sup>o</sup> 32. the *m* beginning from the *u*'s place after the *t* shows, that the next vowel after *m* is *u*; and the mark therefore is equivalent to *transmu—*, which is a sufficient description of the word *transmutation*.

A few examples more will sufficiently explain this rule: as, *recommend, recommendation, commendatory*, N<sup>o</sup> 33. *resignation, resolution, consanguinity*, N<sup>o</sup> 34. *conveniently, superficially*, N<sup>o</sup> 35.

The participles may be abbreviated after the same manner, by adding, instead of the points, the termination *ing* or *ed* to the latter consonant mark; as *confi—ing* for *considering*, *confi—ed* for *considered*, N<sup>o</sup> 36.

Words beginning with double or treble prepositions may be written after the same manner; as, *misinformation, representation, misrepresentation*, N<sup>o</sup> 37. *incomprehensibility*, example first, N<sup>o</sup> 38. The prepositions must always be joined together; and, if two consonants begin the next syllable, the writing of them both will help to discover the remainder of the word; as *misunderstanding*, example second, N<sup>o</sup> 38.

It must appear plainly to every one, upon the least consideration, that the words in the foregoing instances are abbreviated. There can therefore be no danger of mistaking, for example, the mark N<sup>o</sup> 39. for some short word, such as *daily, duly*, &c. For, by our rule, the *d* disjoined always signifies the preposition *de*: nor can it be a word consisting of the preposition *de* and the syllable *li* or *ly* only; for, if such a word had occurred, it would have been sooner written by joining the marks together, as N<sup>o</sup> 40. This way of writing therefore shows, that the word begins with the preposition *de*; that the next syllable is *li*; and that there are some other syllable, or syllables, wanting to complete it. Nor can the consonants in those examples in which the vowels were omitted, be mistaken for terminations; as in this example, N<sup>o</sup> 41. the *k* cannot be supposed to represent the termination *ical*; since it would be absurd to think of describing any word by its preposition and termination only: for as the

\* When one syllable only is wanting, a point cannot be used to express it; for a point so placed must denote a vowel.

same preposition and termination are common to great numbers of words, they alone can never give a good description of any particular one.

This way of reasoning pursued will lead to the discovery of an easy and short method of denoting the words *self* and *selves*, which so frequently follow the pronouns. For, if a disjoined mark loses its power of representing a termination, by being placed close after a preposition, the — must certainly lose that of representing *sion* or *tion*, when placed close after any of the pronouns, since they never admit of such a termination. It must therefore, in that situation, denote only the consonant *s* followed by that vowel from whose place in the line it is drawn; and consequently the words *self* and *selves* may be very commodiously represented by drawing the *s* from the *e*'s place, close after any of the pronouns; as, *myself*, *itself*, *ourselves*, *themselves*, &c. N<sup>o</sup> 42. And though the word *own* should intervene, yet *self* or *selves* may still be signified in the same manner; as, *my own self*, *his own self*, &c. N<sup>o</sup> 43.

The words *what*, *who*, *whom*, *how*, &c. have very often the word *soever* added to them, which may, for a reason similar to the foregoing, be very aptly expressed by the *s* drawn from the place of *o*; as *whatsoever*, *howsoever*, *whomsoever*, &c. N<sup>o</sup> 44.

RULE X. In like manner, words ending in any of the terminations marked in the preceding table of the alphabet, may be denoted by their first consonant and vowel, together with the proper mark of its termination; as, for example, *ar*—ry for *arbitrary*, *op*—ity for *opportunity*, *cu*—ity for *curiosity*, *lawfulness*, N<sup>o</sup> 45.

But it must be carefully observed, that the vowel, whether it precedes or follows the consonant, must never be omitted; otherwise the consonant might be taken for a preposition, and then this rule would interfere with the foregoing: whereas its power of representing a preposition is destroyed by the addition of the vowel, whilst the single disjoined mark, at the end, retains its power of representing a termination. The word is therefore described by its beginning and termination, a vacancy being left in the middle to be supplied by the sagacity of the reader.

RULE XI. It cannot have escaped the observation of any one who has considered the English language with any degree of attention, that words of different significations govern, or require different prepositions; that words, for example, signifying *desire*, *knowledge*, *ignorance*, &c. require the preposition *of*; that other words, importing *mercy*, *compassion*, *dependence*, &c. require the preposition *upon*, &c. Care therefore being taken to write the prepositions plainly, the first consonant only will in many instances be found to be sufficiently descriptive of the words which require those particular prepositions. For although there may be many words which begin with the same consonant; yet all those which do not require that particular preposition, are upon that account immediately excluded; and the remainder is by that means reduced to so few, that it will be easy to select the proper one. In every one of the following sentences (and many more of the like kind might be given) the letter *d* denotes a different word, *viz.* in *He was very d*— of being thought rich; *You may d*— upon my promise; *I d*— from him in opinion; *He d*— long about the choice of a patron, but at last resolved to d— his work to, &c. &c. and yet, by the help of the discriminating prepositions, the particular word proper to each place is easily discoverable.

A few instances will be sufficient to give the learner a right notion of this method of abbreviation.

For example, in the following sentences; *This belongs to me*; *He made some good observations upon it*; *I want to dispose of my house*; *He agreed with me in opinion*;—the words *belongs*, *observations*, *dispose*, *agreed*, may be written as in N<sup>o</sup> 46. And in these sentences, *There was not the least difference between us*; *We must take particular care to guard against such passions as we find ourselves most liable to*; *As for his personal estate, he divided it amongst all his children in equal shares*;—the words *difference*, *guard*, *liable*, and *divided*, may be wrote as in N<sup>o</sup> 47.

And it may be further observed, that as few English words end with the syllable *to*, the proposition *to* may for that reason be joined to the preceding word, which was directed to be signified by its first consonant only. For the unusualness of the ending will be a sufficient hint, that the mark represents not one, but two words; and, therefore, *This belongs to me*, may be written as in example first, N<sup>o</sup> 48. and *liable to*, *satisfactory to*, and *subject to*, may be wrote as in the second, third, and fourth examples, the — in this last instance being made at the bottom of the line, to show that the vowel following it is *u*. But, if any one finds it difficult to write the *u* upwards, he may, whenever it is necessary, distinguish the two last instances from one another, by inserting the *u*, and write *subject to* as in N<sup>o</sup> 49.

Other prepositions, which are denoted in the table of the alphabet by a single consonant, may, in like manner, be joined to the preceding word; as in the example, *He made some good observations upon it*,—*observations upon* may be written as in N<sup>o</sup> 50. Nor will there be any great danger of the reader's being puzzled by mistaking such like marks for single words; for it will not often happen that the two consonants of which they are composed will form any word, scarcely ever that they will form such a word as will suit the place and agree with the context. A little custom will therefore soon suggest to the learner, that the two marks must denote two words; the latter of which, being represented in his short-hand alphabet by the latter consonant mark, must for that reason immediately occur to him.

RULE XII. Prepositions generally require after them either a noun, or a pronoun. The pronouns being few in number, and in all languages used as substitutes for nouns, must occur very frequently, and by that means soon become familiar to the learner; the pronoun, for that reason, may be joined to the preposition, without danger of creating any difficulty to the reader.

As for example, in these sentences, *He gave it to me*, *He left it to my*, *to us*, *to you*, *to our*, *to your*, the words *to me*, *to my*, *to us*, *to you*, *to our*, *to your*, may be wrote as in N<sup>o</sup> 51. The *h*, *th*, or *wh*, may, for the sake of joining, be dropped in the pronouns; which begin with those letters, as *his*, *this*, *whom*, &c. and we may write *to his* as in example first, N<sup>o</sup> 52. and *to this* as in example second; distinguishing, if it ever should be thought necessary, *his* from *this*, by the different situation of the point; *to her* and *to their*, as in example third: for a distinction between them can not be made, as was done in the instance before, by the different placing of the point; but the sense of the passage will easily show which it must be. *To whom*, *to those*, or *to whose*, *to which*, *to each*, may be wrote as in the first four examples, N<sup>o</sup> 53. *It was not in my power*; *in my*, as in the

the fifth example. *It was thrown UNDER MY feet, He came and dwelt AMONGST us, You may be depend UPON ME;* the words *under my, amongst us, upon me,* as in N<sup>o</sup> 54.

This rule is not to be restrained to those prepositions only which are denoted in the table of the alphabet by a single consonant, as *among, under, upon, &c.* but may be extended to others, which must, in that case be represented by their first consonant, and be joined to the pronoun; as, *he did it WITH MY consent,* writing *with my* as in N<sup>o</sup> 55. This will occasion no ambiguity, since *w* cannot in this place signify the word *will*; for such a sentence as, *he did it will my consent,* would be neither sense nor grammar. Its situation in the sentence, and connection with the pronominal adjective *my,* plainly mark that it must be some preposition which begins with *w.*

And though several prepositions should begin with the same consonant, yet they may be written in this manner, provided that the preceding or following words be such as will serve to distinguish them, and shew which of them must needs there be meant; as in the following examples: *He came privately and took it away WITHOUT MY knowledge; To stoop to so mean an action was much BENEATH his dignity; It is BEYOND MY reach. Without my* may be written as *with my,* N<sup>o</sup> 55. and the words *beneath his, beyond my,* as in N<sup>o</sup> 56. *Above* may be distinguished from *beyond,* by prefixing the initial vowel. Thus, in the following sentence, *it is ABOVE MY comprehension, above my* may be wrote as in example first, N<sup>o</sup> 57. and *between them, before my, behind my,* in these sentences, *They divided it equally BETWEEN THEM, He had the impudence to do it BEFORE MY face, He did it slyly BEHIND MY back,* may be wrote as in the three last examples, N<sup>o</sup> 57.

But it is to be noted here, that when the prepositions themselves are abbreviated, as in these instances above, they cannot help to explain other words, as they did in those mentioned in the beginning of the 1<sup>th</sup> Rule, in which they were directed to be written plainly; for it would be very puzzling indeed, if that word, which was to assist in explaining others, wanted explanation itself.

RULE XIII. After the learner has, by a little practice, made the last method of abbreviation familiar to himself, he may venture to combine it with the foregoing, and join the preceding word, the preposition, and pronoun all together: and as he had learned before to write *belongs to,* as in example first, N<sup>o</sup> 58. and as the last rule taught him to write *to me* as in example second, he may now join them all together, and write *belongs to me, extends to us, agreed with me, depend upon me,* as in N<sup>o</sup> 59.; *observations upon this,* as in example first, N<sup>o</sup> 60.; and *rebellion against his, dissensions amongst his,* as in the two following sentences, *He was a notorious traitor and caught in actual REBELLION AGAINST HIS Majesty, He was an ill natured man, and always endeavouring to sow DISSENSIONS AMONGST his neighbours,* may be wrote as in N<sup>o</sup> 60.

When a pronoun, or a preposition and pronoun, follow the verb, and are themselves followed by a preposition and pronominal adjective, they may all be joined together; as, *I CONGRATULATED HIM UPON HIS, &c. I CONDOLED WITH HIM UPON HIS,* N<sup>o</sup> 61.

The words *some, any, none, which, each, both, &c.*

followed by a preposition and pronoun, may, agreeably to this rule, be denoted by their first consonants, and be joined to the preposition and pronoun; as, *some of them, any of us, none of them,* N<sup>o</sup> 62. *both of them, which of them, each of them,* N<sup>o</sup> 63. The first dot is inserted to distinguish the words from one another which begin with the same consonant; as, *none, any, &c.* The latter dot must never be omitted, as it is the appointed way of writing the pronouns when joined to prepositions; as, *of them;* N<sup>o</sup> 64.

RULE XIV. After the learner has for some time accustomed himself to the foregoing rule, he may advance a step further, and join the adverbs preceding the verbs, and the substantives following the pronominal adjectives, to the verbs and adjectives respectively, denoting both the adverbs and substantives by their first consonants, or at most by their first consonants and vowels; as for example, in this sentence, *you may SAFELY DEPEND UPON MY WORD, safely depend upon my word* may stand as in N<sup>o</sup> 65. \*

Difficult as this may seem to a beginner, yet habit, and a little reflection upon the nature of our language, will quickly render it easy to him. His own experience will soon convince him, that contractions, when judiciously made, may be more certainly and easily read than the unexperienced are apt to imagine. It may, perhaps, for a while at the first, be a good method to take the contractions to pieces, writing in long-hand exactly what is given in short-hand. The foregoing contraction so transcribed would stand thus, *you may sa—d—upon my w—.* Here the preposition *upon* will soon suggest, that the preceding word, beginning with the consonant *d,* must be *depend*; and the word denoted by its initial letters *sa,* coming betwixt the auxiliary *may,* and the verb *depend,* is by its situation, according to the usual arrangement of words in our language, plainly enough marked to be an adverb; so that it is nearly the same as if it had been written thus, *You may sa—ly depend upon my w—,* which is too plain a description to prove a stumbling-block to any attentive reader.

RULE XV. Many common phrases, formed by a substantive preceded by the prepositions *with, without, in, &c.* and followed by *to, of, &c.* may be very conveniently contracted; as, *with regard, respect, or reference to,* N<sup>o</sup> 66. example first. *He basely broke his promise, WITHOUT ANY REGARD TO HIS honour; without any regard to his,* as in example second; *in relation to,* as in the third example; *in order to, in consequence, comparison, or consideration of, in obedience to your,* N<sup>o</sup> 67.; *by reason of his, by virtue of his,* N<sup>o</sup> 68. (in this last instance, the proportionably little *b* shows, that the mark following it is to be divided into two letters;) *upon account of, in the power of,* N<sup>o</sup> 69.

RULE XVI. Common adverbial phrases are, in like manner, often denoted by their initial consonants joined together; as, *for the future, at the same time, at present, in this manner,* N<sup>o</sup> 70.; *in like manner, in a great measure, in the same manner,* N<sup>o</sup> 71.; *in so much that, so much the more, in the mean time,* N<sup>o</sup> 72.; *in general, in particular,* N<sup>o</sup> 73.

And when the proportion of equality is expressed by *so—as, or as—as,* with some one word intervening, they may be all joined together; as, *so much as, as much as,*

\* As a substantive must necessarily follow the adjective *my,* there was no occasion to place the point at the end of the *w* to shew that it was one.

as well as, as long as, as good, or as great as, &c. N<sup>o</sup> 74.

RULE XVII. The contractions which may be made when it is or it was are followed by an adjective, and to or that, are so numerous, that we must content ourselves with giving a few of the most usual; as, it is impossible to, it was unnecessary to, it is contrary to, N<sup>o</sup> 75; it is according to, it is observable that, it is evident that, it is not to be supposed that, &c. N<sup>o</sup> 76.

The above methods of abbreviation are such as are of most common use and practice: and though they are not many in number, yet they are very extensive in their application; for a sentence can scarce occur in which some one or other of them will not find a place. But yet we are far from pretending to have exhausted the subject. An accurate and assiduous attention to the nature and idiom of our language may suggest others as useful and extensive as these. Proper care being taken to lay a right foundation, the legible ways of contracting will increase, in proportion to the writer's want of them. The more he writes, the more concisely he may venture to write, and yet be able to read his contractions with ease; provided that he builds them upon some known particularity of our language: for which reason we have been more solicitous to explain the grounds of our rules, than curious in the choice, or copious in the number of examples. But that the learner may have all the assistance necessary, we have furnished him with specimens, (Plates CLIII. CLIV. CLV) where he will find his rules exemplified; and as the last specimen is taken from a book not in every person's possession, we have given the passage in a note\*.

But it may not be amiss, before we conclude, to make a

\* PROCEEDINGS on an *Habeas Corpus* upon the commitment (by Sir William Turnbul Secretary of State) of Kendale and Roe for High Treason, 31 October 1695.---Sir Bartholomew Shower, for the prisoners, spoke as follows.

Sir Bartholomew Shower. I am of council for these two prisoners: and what we desire at present is only that they may be bailed; though perhaps we might prefer to have them discharged, and that upon good reason.

To induce your Lordship to bail them, I must beg your Lordship's pardon, and I hope Mr. Attorney will be so good as to make a question whether the person committing hath any authority for such a purpose. It is for my clients, who think themselves aggrieved by this imprisonment: and in truth they say, that they are somewhat hardly dealt withal in this case; for the information against them is only for being privy to, and assisting the escape of the centinels who were privy to Sir James Montgomery's escape. But this is fact of which the court will not take notice; and therefore I shall confine myself to the return, as it appears before your Lordship.

With submission, I must insist upon it, that a secretary of state, *quatenus* secretary, cannot commit for treason or felony: he is not an officer for such a purpose in common parlance. The word secretary imports only a *writer of letters* or other scraps for a superior; and, as Spellman explains the word, this is the sense of it, with the addition of secrecy, of privacy; and so is his glorying upon that word. He is not a privy-councillor, *quatenus* a secretary; nor is he a justice: and though perhaps, in fact, he may be in the commission; yet, unless he hath taken the oath of that office upon a *dedimus*, he cannot act as such: and I have seen five or six privy-councillors at a time appearing at sessions of the peace for this country, in the case of the Duke of Bedford's power, as *justi rationum*, to remove the clerk of the peace; and when intimation was made them of the justices oath which they had not taken, they refused to vote, and did thereupon withdraw. Here Sir William Turnbul cannot be presumed or intended to be a justice of the peace; because the commitment by him is as secretary, and not as justice; and so is the return: and upon the return the authority by which he commits ought to appear, otherwise the return is vicious; and here doth appear none but that of a secretary. Now, if the office of secretary doth not imply and carry in it a power of committing, then this commitment is erroneous.

Our constitution hath distributed the administration of justice, both in criminal and civil causes, into several courts; and hath appointed several officers for several purposes; some for civil, some for criminal matters; and in criminals some are to examine and commit, others to obey and carry, others to receive and keep, some to try and sentence, others to execute; each hath his proper province: and of those your Lordship will take notice, as also of their several duties and powers; and do to our law-books. But a secretary is a court-officer of state, not relating to the administration of justice.

You take notice, as do our books, of head-boroughs, constables, sheriffs, coroners, escheaters, and the like: But neither *Crompton*, *Fitzherbert*, *Smith*, or any book which treats of the jurisdiction of courts, the pleas of the crown, or the officers of justice, do ever mention a secretary of state: his office rather relates to foreign negotiations than domestick; and if any home-affairs fall under his cognizance, it is rather as an intelligencer than with any relation to criminals, prisoners, or gaolers, &c. In all the debates about the liberty of the subjects, and wronged commitments, which were in parliament in 4 Car. I. or 1628; and amongst all the precedents mentioned there upon each side, which are multitudes; there is

remark or two upon abbreviations in general.—First, that in all the various ways that can be taken of contracting, (that is of describing words by some shorter method than that of writing all the consonants of which they consist,) care must be taken, when the contraction consists of two or more words joined together, that no one word of it be represented by more than one character; and secondly, that the whole mark, by some means or other, if possible, be shown to be a contraction, as it has been generally done in the foregoing pages, either by the insertion of points in the middle of the marks, as N<sup>o</sup> 77. (Plate CLIII.) for *some of them*; (which, when dispatch is required, is never practised to denote vowels in the middle of words;) or by the unusual ending of the mark, as N<sup>o</sup> 78. for *liable to*, appears *that*; for few words (since the termination *eth*, so frequent in scripture-language, is now almost grown obsolete) end in *th*; or by the unusual joining of the marks, as, in *the*, *it is*, &c. N<sup>o</sup> 7. Otherwise the reader might be puzzled in hunting for some one word consisting of the letters which are written: whereas, if he knows it to be a contraction, he is not bewildered in his researches, but is at first directed the right road, and has nothing to do but to search after some word for every character, which will suit the description, and agree with the context.

And when contractions are judiciously made, the learner, provided he will observe the caution already given, (and which cannot be too often repeated,) of beginning with the easiest, and of not proceeding to a second, until the first is become familiar, will certainly find the difficulty of decyphering them lessen every day.

But, supposing that there was more difficulty in the reading

ing none by a secretary. It is true, there are divers *per mandatum Dom. Regis*, by warrant from the Lords of the council. I have perused Dr. Franklin's Annals of King James the 1<sup>st</sup>. fol. 261. and *Rufusworth*, Vol. 1. 458. and can find none by a warrant from a secretary. I have read *Coke's*, *Selden's*, and *Littleton's* arguments upon that subject, but see nothing of a secretary's commitment. And it seems very strange, if such a power were lodged in this late-officer, that there should be no precedents for it in those times, when extrajudicial and general warrants were so frequent, that they became a grievance to the people, and such a one as laid the foundation for the petition of rights.

I shall not controvert the power of the council at present, because it doth not concern the present question: All that I can observe in the case is, that it first began to be practised in the reign of Charles the first, and yet, even in 1678, when the Popish plot had increased the number of prisoners to a wonderful degree, it is notoriously known, that the chief Justice Scroggs was frequently and often sent for to Whitehall, to examine, and commit, and grant warrants. And sometime since the secretaries of state have thrown that burden off from themselves upon their secretaries under them, who have been sworn justices of the peace; and Mr. Bridgeman hath accordingly executed the office of a justice of peace at Whitehall, and that frequently. It hath been a question, Whether a chanceller, or keeper of the great seal, can commit; and the better opinion hath been, that he cannot: And it seems to be agreed by *Granville's* and other cases in *Moor's* Reports, 839. 840. that his commitment is illegal, unless for a cause within his jurisdiction as a court of equity: and the matters must so appear. I must agree, that any man may apprehend another for felony or treason; but there is a vast difference between an arresting of a traitor or felon upon suspicion or knowledge, and a formal commitment to prison with a charge of treason. And I am sure Mr. Attorney General will not insist upon this reason; for then the consequence will be, that any man may commit, as well as a secretary. And I suppose that doctrine will scarce be allowed; though I think that any man may, as well as a secretary, be taken upon suspicion or felony, or hue and cry, or the like, is not to detain, but to carry to a constable or justice, as in 3. *inst.* 52. Then here the gaoler doth not return that he detains him, because he is guilty or suspected; but because, by virtue of such a warrant, he is committed to his custody.

Besides, the reason of our law is against it; for a secretary cannot administer an oath. Now the law requires, that no man should be committed by an extrajudicial warrant, unless upon oath. If there be such a suspicion, there ought to be oath of the cause of that suspicion; for the person committing cannot commit upon another's suspicion, unless there be oath of some reasonable cause for it. He cannot take bail for any person accused, he cannot take a recognizance to prosecute. And I may very well challenge any man living to show me any one recognizance ever returned into any court, that was taken by a secretary, either for appearance of a criminal, or for the prosecution of one. And the practice is always otherwise; for they have often taken bonds to the king with condition to appear here. And your Lordship, and the court, hath often had much trouble in that matter; for they being bound to appear here, the court hath refused to receive their appearance, because no recognizance returned or taken whereupon to found such an appearance.

Now it seems strange, may abund, that our constitution, which we admire for its wisdom, should appoint an officer who would commit, and yet cannot give an oath whereon to found a commitment, that cannot bail, that cannot take any recognizance to prosecute: This is to make the liberty of the subject very precarious, notwithstanding the many laws and sayings of judges in favour of it, &c. STATE TRIALS, Vol. V. Page 605.

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 5 i j  
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 12 u u u  
 13 u u u  
 14 i i i  
 15 e e e  
 16 o o o  
 17 a a a  
 18 j j j  
 19 l l l  
 20 s s s  
 21 z z z  
 22 c c c  
 23 e e e  
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*Part of Dr. Sherlock B<sup>o</sup> of London's 1<sup>o</sup> sermon with a few of the most common Contractions.*

316. 67, 68, 69. r r l y 1/2 p x z  
 e f; r r r r h, s, h e f e; r i l v w  
 a; (r x) (77) (r a) z, i r v e.  
 y v r l e; r a r i h v v t b e n l e v,  
 (r v l e y e z, (p r u d h,) e e. v  
 ? l - t 1/2, p x z e f; h y), y v l e; z y,  
 p h e f e; r i l v a, (r x) (77) (r e,  
 i r v e. r r r r r r r r r r, - i e y  
 v r e (r i e. i v r, i r r r r r r r r r  
 r e v r h, y y u h (e v r, p h e f e; i r y r,  
 i a l e; (i l r r r r r r r r r r - e l y \,  
 r, r r r r r, r i l v a. i h -, i h (e  
 e r - v e, h l v (r v y, r x) (77) (r  
 r - i r v e. t x, r r r r r r r r r r r r,  
 - r r v, (l - r - r y r r r r r r, r x, r r  
 r, v i r r r r r r r r r r, r r r r r r r r r r,  
 i r v e. l e e, r y) e v (r i e. r i r  
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 - v r, r, i y r r r r r r r r r r r r r r r r  
 i a r r (e e v y, l y, y v r r r r r r, o u r  
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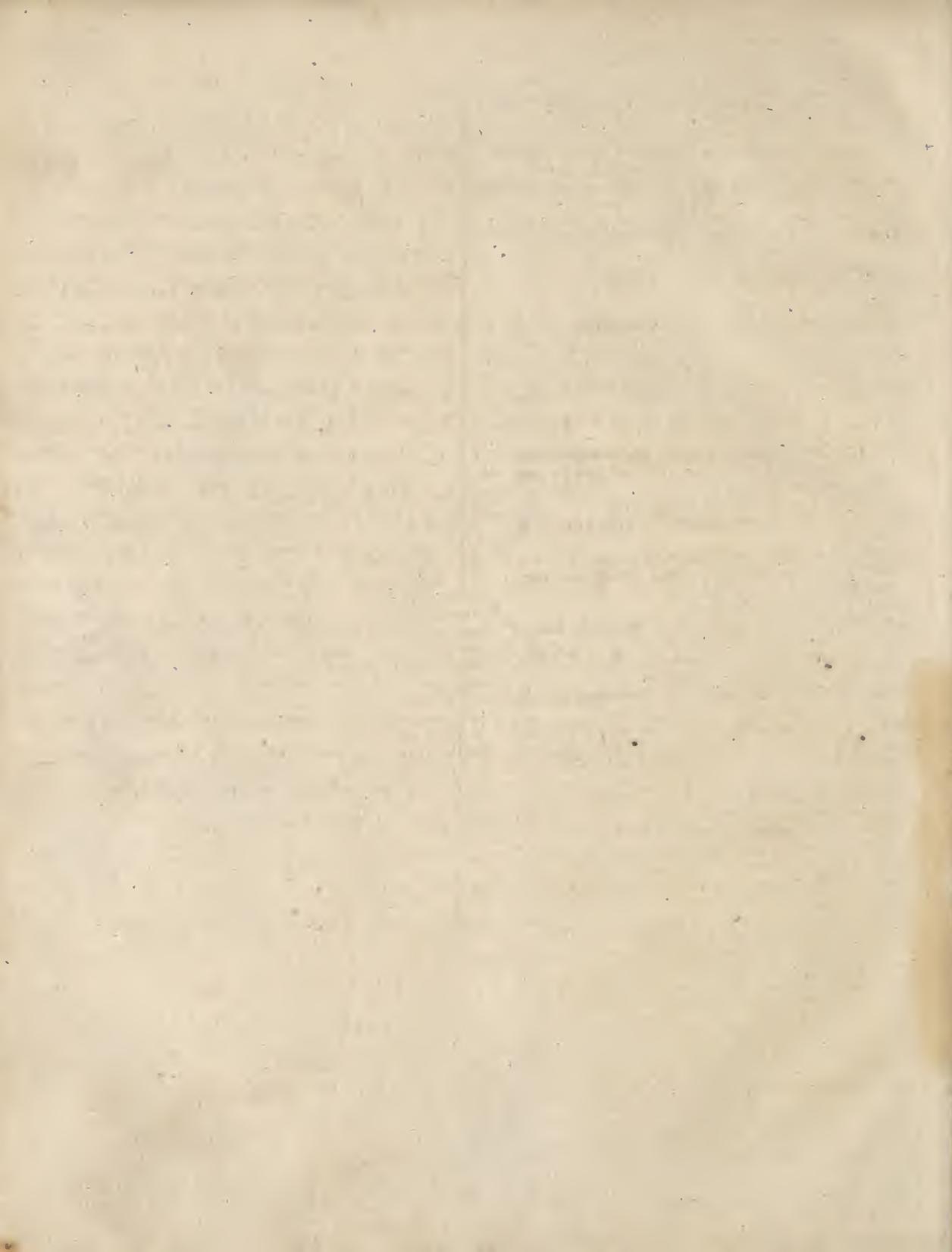
• ενωνισμεν











ing of them; yet, provided that they may be certainly made out by due attention to the subject treated upon, and the idiom of the language, it will be sufficient: for the learner must be advertised, that these contractions are not designed to be taught as the common standard method of writing short-hand upon all occasions.—That method which was taught in the first part, and which will be as easily read, upon a little practice, as common long-hand, will be found sufficiently short for all common purposes; and it should therefore be kept to when very great dispatch is not required.

Inventors of short-hand have generally introduced into their systems a multitude of *arbitrary* marks, to signify particular words and phrases, which are often chosen rather upon account of their length than their frequent occurrence. The injudicious application of these arbitrary marks is not

the only objection against them. They are not only burdensome to the memory, and tedious and difficult to be learned, but are forgot even by the writer himself, unless he sits down to decypher immediately whilst every thing is fresh in his memory.

These objections lie not against the above methods of abbreviation. They burden the memory with no new and arbitrary marks, and with but few rules for the extension of the powers of the alphabetical characters; and the rules are so general, and applicable to such a multitude of cases perpetually occurring, that they give this system the advantage, even in point of expedition, over arbitrary marks, and at the same time leave the writing legible, whatever length of time intervenes, not only to the writer himself, but also to every fellow-practiser of the same method.

S I A

SHOT, a denomination given to all sorts of balls for fire-arms; and those for cannon being of iron, and those for guns, pistols, &c. of lead.

SHOVELER, in ornithology. See ANAS.

SHOULDER BONE, in anatomy. See ANATOMY, p. 175.

SHOULDER-BLADE. See ANATOMY, p. 176.

SHOWER, in meteorology, a cloud resolved into rain. See RAIN.

SHREW MOUSE. See MUS.

SHREWSBURY, the county-town of Shropshire, situated on the river Severn: W. long. 2° 46', N. lat. 52° 46'. It sends two members to parliament.

SHRIMP, in ichthyology. See SQUILLA.

SHRINE, in ecclesiastical history, a case or box, to hold the relics of some saint.

SHROPSHIRE, a county of England, bounded by Cheshire on the north, by Staffordshire on the east, by Herefordshire on the south, and by Montgomeryshire on the west.

SHROVE-TUESDAY, is the Tuesday after Quinquagesima Sunday, or the day immediately preceding the first of Lent; being so called from the Saxon word *shrive*, which signifies to *confess*, as having been employed by the people in time of popery, in confessing their sins, in order to receive the sacrament, and thereby qualify themselves for a more religious observation of Lent.

SHROWDS, in a ship, are the great ropes which come down both sides of the masts, and are fastened below to the chains on the ship's side, and aloft to the top of the mast; being parcelled and served in order to prevent the mast's galling them. The top-mast shrowds are fastened to the puttock-plates, by dead eyes and laniards, as the others are.

SHRUB, among naturalists, denotes a dwarf-tree, or a woody plant less than a tree; such are holly, box, privet, &c.

SHUTTLE, in the manufactures, an instrument much used by weavers, in the middle of which is an eye, or cavity, wherein is inclosed the spool with the woof.

SI, in musick, a seventh note or sound, added by Le Maire to the six ancient notes invented by Guido Aretine, viz. *ut, re, mi, fa, sol, la, si*.

SIAM, the capital of a kingdom of the same name, in the

S I C

further peninsula of India: E. long. 101°, N. lat. 14°. SIBA, a province of the hither India, situated between Tibet on the east, and Labor on the west.

SIBALDIA, in botany, a genus of the pentandria pentagynia class. The calix consists of ten segments, and the corolla of five petals inserted into the calix; the styli are placed on the side of the germen; and there are five seeds. The species are two, only one of them, viz. the procumbens, or bastard cinquefoil, a native of Britain.

SIBERIA, or ASIATIC RUSSIA, the most northern country of Asia, situated between 60° and 130° E. long. and between 47° and 72° N. lat. being upwards of two thousand miles in length from east to west, and one thousand five hundred miles in breadth from north to south. We include the Calmuc Tartars within the limits of Siberia, as they acknowledge themselves subject to the empire of Russia.

SISTHORPIA, in botany, a genus of the didynamia angiospermia class. The calix consists of five segments, and the corolla of five equal ones; the pairs of stamina are remote; the capsule is compressed, globular, and has two cells, with a transverse dissepimentum.

SIBYLS, in pagan antiquity, certain women said to have been endowed with a prophetic spirit, and to have delivered oracles foretelling the fates and revolutions of kingdoms, &c.

The most eminent of the ten sibyls mentioned by ancient writers, was she whom the Romans called the Cumæan or Erythræan sibyl, from her being born at Erythræ in Ionia, and removing from thence to Cumæ in Italy, where she delivered all her oracles from a cave dug out of the main rock, according to Virgil, *Æn.* III. 441, &c.

There is still preserved, in eight books of Greek verses, a collection of verses pretended to have been delivered by the sibyls; but the generality of critics look upon it as spurious: and it is the opinion of Prideaux, that the story of the three books of the sibyls, sold to Tarquin, was a state-trick or fetch of politics.

SICILY, the largest of all the Italian islands, anciently called Trinacria, from its triangular figure: it is situated between 12° and 16° E. long. and between 37° and 39° N. lat. being about one hundred and seventy miles long, and one hundred broad.

- It is separated from Calabria, in Italy, by the straits of Messina, which, in the narrowest part, is not seven miles over.
- SICYOS**, in botany, a genus of the monœcia syngenesia class. The calix and corolla of the male have each five segments; and there are three filaments; the calix and corolla of the female are the same with those of the male; the stylus is trifid; and the drupa contains one seed. There are two species, none of them natives of Britain.
- SIDA**, in botany, a genus of the monadelphia polyandria class. The calix is simple and angular; the stylus is divided into many parts; and there are many capsules, each containing one seed. There are 23 species, none of them natives of Britain.
- SIDEREAL YEAR**. See **ASTRONOMY**, p. 458.
- SIDERIA**, in natural history, the name of a genus of crystals, used to express those altered in their figure by particles of iron. These are of a rhomboidal form, and composed only of six planes. Of this genus there are four known species: 1. A colourless, pellucid, and thin one, found in considerable quantities among the iron ores of the forest of Dean in Gloucestershire, and in other the like places. 2. A dull, thick, and brown one, not uncommon in the same places with the former. And, 3. A black and very glossy kind, a fossil of very great beauty, found in the same place with the others, as also in Leicestershire and Suffex.
- SIDERI FIS**, in botany, a genus of the didynamia gymnospermia class. The stamina are within the tube of the corolla; and there is a short stigma over-lapping another one. The species are eleven, none of them natives of Britain.
- SIDEROXYLUM**, in botany, a genus of the pentandria monogynia class. The corolla consists of ten segments alternated crooked inwards; the stigma is simple; and the berry contains five seeds. There are three species, none of them natives of Britain.
- SIDMOUTH**, a port-town of Devonshire, situated on a bay of the English channel, ten miles south-east of Exeter.
- SIDON**, or **SAYD**, a port-town of Palestine, in Asiatic Turkey, seventy miles north of Jerusalem. It is still a place of some consideration, being the residence of a Turkish bashaw.
- SIDRA**, an island of the Archipelago, situated at the entrance of the gulph of Napoli.
- SIEGE**, in the art of war, the encampment of an army before a fortified place, with a design to take it.
- SIENNA**, a city of Italy, in the duchy of Tuscany, situated thirty-six miles south of Florence.
- SIERRA LEON**, a river of Guinea, which falls into the Atlantic ocean, in W. long 14°, and N. lat. 7°.
- SIEUR**, a title of respect among the French, like *master* among us: it is much used by the lawyers, as also by superiors in their letters to inferiors.
- SIGAN**, a town of China, in the province of Xensu: E. long. 108°. and N. lat. 34°.
- SIGESBECKIA**, in botany, a plant of the syngenesia polygamia superflua class. The receptacle is paleaceous; it has no pappus; the involucreum has five leaves; and the radius is dimidiated. There are two species, none of them natives of Britain.
- SIGETH**, a town of lower Hungary, situated seventy-three miles south-west of Buda, and subject to the house of Austria.
- SIGHT**, or **VISION**. See **OPTICS**.
- SIGISTAN**, the capital of a province of the same name, in Persia: E. long. 62°, and N. lat. 31°.
- SIGN**, in general, the mark or character of something absent or invisible.
- Among physicians, the term sign denotes some appearance in the human body, which serves to indicate or point out the condition of the patient, with regard to health or diseases.
- SIGN**, in algebra. See **ALGEBRA**, p. 80.
- SIGN**, in astronomy. See **ASTRONOMY**, p. 435.
- SIGNATURE**, a signing of a person's name at the bottom of an act or deed, wrote by his own hand.
- SIGNATURE**, in Scots law. See **LAW**, Tit. xii. 24.
- SIGNATURE**, in printing, is a letter put at the bottom of the first page at least, in each sheet, as a direction to the binder in folding, gathering, and collating them. The signatures consist of the capital letters of the alphabet, which change in every sheet: if there be more sheets than letters in the alphabet, to the capital letter is added a small one of the same sort, as Aa, Bb; which are repeated as often as necessary. In large volumes it is usual to distinguish the number of alphabets after the first three or four, by placing a figure before the signature, as 5 B, 6 B, &c.
- SIGNET**, one of the king's seals, made use of in sealing his private letters, and all grants that pass by bill signed under his majesty's hand: it is always in the custody of the secretaries of state.
- SIGNET**, in Scots law. See **LAW**, Tit. iii. 16.
- SILENE**, in botany, a genus of the decandria trigynia class. The calix is ventricose; the corolla consists of five unguiculated petals; and the capsule has three cells. There are 34 species, 6 of them natives of Britain.
- SILESIA**, a duchy belonging to the king of Prussia; two hundred miles long, and seventy broad: it is bounded by Brandenburg on the north, by Poland on the east, by Hungary on the south, and by Moravia and Bohemia on the west.
- SILESIAE EARTH**, in the materia medica, a fine astringent bole. It is very heavy, of a firm compact texture, and in colour of a brownish yellow. It breaks easily between the fingers, and does not stain the hands; is naturally of a smooth surface, and is readily diffusible in water, and melts freely into a butter-like substance in the mouth. It leaves no grittiness between the teeth, and does not ferment with acid menstrua. It is found in the perpendicular fissures of rocks near the gold-mines at Strigonium in Hungary, and is supposed to be impregnated with the sulphur of that metal. It is a good astringent, and better than most of the boles in use.
- SILIQUEA**, a term used by botanists to denote a pod.
- SILIQUEA**. See **BOTANY**, p. 637.
- SILK**, is properly an animal fluid, hardened by the air; being an extremely soft and glossy thread, spun by the silk-worm, the body of which consists of eleven rings.
- The humours found in the body of this insect approach to the nature of silk; since, on being rubbed in the hand, they leave a solid crust behind. In the sides of the belly, all about the ventricle, there are deposited a vast number of vessels, which contain the silky juice: these run with various windings and meanders to the mouth; and are so disposed,

disposed, that the creatures can discharge their contents at pleasure at the mouth; and, according to the nature of the juices that they are supplied with, furnish different sorts of silk from them, all the fluid contents of these vessels hardening in the air into that sort of thread that we find the web or balls of this creature consist of.

As soon as the silk-worm is arrived at the size and strength necessary for beginning his cocoon, he makes his web; for it is thus they call that slight tissue which is the beginning and ground of this admirable work. This is his first day's employment. On the second he forms his folliculus or ball, and covers himself almost over with silk. The third day he is quite hid; and the following days employs himself in thickening and strengthening his ball; always working from one single end, which he never breaks by his own fault; and which is so fine, and so long, that those who have examined it attentively think they speak within compass, when they affirm, that each ball contains silk enough to reach the length of six English miles.

In ten days time the ball is in its perfection, and is now to be taken down from the branches of the mulberry tree, where the worms have hung it. But this point requires a deal of attention: for there are some worms more lazy than others; and it is very dangerous waiting till they make themselves a passage, which usually happens about the fifteenth day of the month.

The first, finest, and strongest balls are kept for the grain, the rest are carefully wound; or if it is desired to keep them all, or if there be more than can be well wound at once, they lay them for some time in an oven moderately hot, or else expose them for several days successively to the greatest heats of the sun, in order to kill the insect, which, without this precaution, would not fail to open itself a way to go and use those new wings abroad it has acquired within.

Ordinarily, they only wind the more perfect balls; those that are double, or too weak, or too coarse, are laid aside, not as altogether useless, but that, being improper for winding, they are reserved to be drawn out into skeins. The balls are of different colours; the most common are yellow, orange-colour, isabella, and flesh colour; there are some also of a sea-green, others of a sulphur colour, and others white; but there is no necessity for separating the colours and shades to wind them apart, as all the colours are to be lost in the future scouring and preparing of the silk.

In the philosophical transactions, n<sup>o</sup> 252, we find the following observations concerning the goodness of silk, which is best distinguished by its lightness. The organic silk is the best made in the country of Piedmont of any; and two threads are equal in fineness, that is, in smoothness, thickness, and length, for the thread of the first twist. For the second, it matters not whether the single thread be strong before the two are joined, unless to see whether the first twist prove well.

It is necessary that the silk be clean; and it is to be observed, that the straw-coloured is generally the lightest, and the white the heaviest of all. The skeins should be even, and all of an equality, which shews that they were wrought together: otherwise we may with justice suspect that it is refuse silk, and cannot be equally drawn out and spun; for one thread will be shorter than the other, which is labour and loss.

It will also be requisite to search the bale more than once, and take from out of the parcels a skein to make an essay; for unless it be known, by trial, what one buys, there is the greatest danger of being cheated in this commodity. To make an estimate, and know the lightness, fix the essay upon one eighth of a portée or hand of silk of a hundred and ten aunes or ells of Lyons in length, and see what it makes of aunes by the eighth part. The skein, which is of eighty threads, must be multiplied by a hundred and ten aunes of Lyon, and from this number must be deducted one eighth: as for example, 110 by 80 makes 8800, the eighth part of which is 1100: and this is the eighth part of a portée, or hand of silk. Now, to calculate what these 1100 aunes weigh, which is the eighth part of a portée, or of 110 aunes of Lyons, it will be proper to take a skein out of the parcels, which you take out from the bale which you judge may contain at least 1100 aunes, to make the one eighth part of a portée; which portée must be divided on two bobbins, half on each; then fix the two bobbins on the centre, or beam, and from thence pass it through the comb hurdissoir, viz. 550 from the two bobbins, will make 1100, which will be one eighth part of what you desire to know. This done, you cut off your silk, and carry it to put on the hurdissoir: then weigh it, and multiply the weight by eight, it will weigh just as much as a portée of 110 aunes of Lyons, which is the general rule for calculating. When they draw the silk out by this means, one may learn to adjust the weight.

There are silks of Piedmont, which are very light and clean, and are to be preferred before any on the sale: the portée of silk of the lightest weighs near twenty-four penny-weights, and from this it arises in gravity to twenty-five and twenty-six penny-weights the portée, and sometimes to twenty-seven and twenty-eight: but even these weights may be dispensed with, provided that the other qualities be good, that is, that it be well wrought, even and clean. When the silk is more than twenty-eight penny-weights the portée, it must always be proportionably cheaper.

*Methods of preparing SILKS.* The several preparations which silks undergo to fit them to be used in the manufacture of silken stuffs, are reeling, spinning, mulling, bleaching, and dying. To wind silks from off the balls, two machines are necessary; the one a furnace, with its copper; the other a reel, or frame, to draw the silk. The winder, then, seated near the furnace, throws into the copper of water over the furnace (first heated and boiled to a certain degree, which custom alone can teach) a handful or two of balls, which have been first well purged of all their loose furry substance. She then stirs the whole very briskly about with birchen rods, bound and cut like brushes; and when the heat and agitation have detached the ends of the silks of the pods, which are apt to catch on the rods, she draws them forth; and joining ten or twelve, or even fourteen of them together, she forms them into threads, according to the bigness required to the works they are destined for: eight ends sufficing for ribbands; and velvets, &c. requiring no less than fourteen. The ends, thus joined into two or three threads, are first passed into the holes of three iron rods, in the fore-part of the reel, then upon the bobbins or pullies and at last are drawn out to the reel itself, and there fastened each to an end of an arm or branch of the reel. Thus disposed, the winder, giving motion to the reel,

reel, by turning the handle, guides the threads; substitutes new ones, when any of them break, or any of the balls are wound out; strengthens them, where necessary, by adding others; and takes away the balls wound out, or that, having been pierced, are full of water.

In this manner, two persons will spin and reel three pounds of silk in a day; which is done with greater dispatch than is made by the spinning-wheel or distaff. Indeed, all silks cannot be spun and reeled after this manner; either by reason the balls have been perforated by the silk worms themselves; or because they are double, or too weak to bear the water; or because they are coarse, &c. Of all these together, they make a particular kind of silk, called *floretta*; which being carded, or even spun on the distaff, or the wheel, in the condition it comes from the ball, makes a tolerable silk.

As to the balls, after opening them with scissars, and taking out the insects (which are of some use for the feeding of poultry,) they are steeped three or four days in troughs, the water whereof is changed every day to prevent their stinking. When they are well softened by this scouring, and cleared of that gummy matter the worm had lined the inside withal, and which renders it impenetrable to the water, and even to air itself, they boil them half an hour in a lye of ashes, very clear and well strained; and after washing them out in the river, and drying them in the sun, they card and spin them on the wheel, &c. and thus make another kind of *floretta*, somewhat inferior to the former.

As to the spinning and reeling of raw silks off the balls, such as they are brought from Italy and the Levant, the first is chiefly performed on the spinning-wheel; and the latter, either on hand-reels, or on reels mounted on machines, which serve to reel several skains at the same time. See REEL.

As to the milling, they use a mill composed of several pieces, which may mill two or three hundred bobbins at once, and make them into as many skains.

For the dying of silk, see DYING.

**SILPHIUM**, in botany, a genus of the *syngenesia polygamia necessaria* class. The receptacle is paleaceous; it has no pappus; the calix consists of three valves; and the radius of the corolla is dimidiated. There are six species, none of them natives of Britain.

**SILVER**. See CHEMISTRY, p. 79, 130.

**SILVERING**, the covering of any thing with silver. It is usual to silver metals, wood, paper, &c. which is performed either with fire, oil, or size. Metal-gilders silver by the fire; painter-gilders all the other ways.

To silver copper or brass: 1. Cleanse the metal with aquafortis, by washing it lightly, and immediately throwing it into fair water; or by heating it red hot, and scouring it with salt and tartar, and fair water, with a small wire-brush. 2. Dissolve some silver in aquafortis, in a broad-bottomed glass vessel, or of glazed earth, then evaporate away the aquafortis over a chaffing-dish of coals. 3. Put five or six times its quantity of water, or as much as will be necessary to dissolve it perfectly, on the remaining dry calx: evaporate this water with the like heat: then put more fresh water, and evaporate again, and, if need be, the third time, making the fire towards the latter end so strong, as to leave the calx perfectly dry, which, if your silver is good, will be of a pure

white. 4. Take of this calx, common-salt, crystal of tartar, of each a like quantity or bulk; and mixing well the whole composition, put the metal into fair water, and take of the said powder with your wet fingers, and rub it well on, till you find every little cavity of the metal sufficiently silvered over. 5. If you would have it richly done, you must rub on more of the powder; and in the last place wash the silvered metal in fair water, and rub it hard with a dry cloth.

**SILVERING of Glasses**. See FOLIATING of Looking-glasses.

**SIMIA**, the MONKEY, in zoology, a genus of quadrupeds belonging to the order of primates. They have four fore-teeth in each jaw, placed near each other; the dog-teeth are solitary, and remote; and the grinders are obtuse. There are 33 species: Of these, three, *viz.* the satyrus, sylvanus, and inuus, have no tail. Other three of them, *viz.* the nemeltrina apedia, and sphinx, have short tails. The other 27 have long tails. The specific distinctions are taken from the colour, and other circumstances.—The monkey-kind are remarkable for activity, a low species of cunning, and a facility of imitating the actions of men and other animals. The sagacity and docility of the simia are so well known, that it is needless to spend time in giving instances of either.

**SIMILE**, or SIMILITUDE, in rhetoric, a comparison of two things, which though different in other respects, yet agree in some one. The difference between a simile and comparison, is said to consist in this, that the simile properly belongs to whatever we call the quality of the thing, and the comparison to the quantity.

**SIMONICAL**, is applied to any person guilty of simony. See SIMONY.

**SIMONIANS**, in church-history, a sect of ancient heretics, so called from their founder Simon Magus or the magician. The heresies of Simon Magus were principally his pretending to be the great power of God, and thinking that the gifts of the Holy Ghost were venal, and to be purchased with money. He is said to have invented the *Æons*, which were so many persons of whom the Godhead was composed. His concubine Helen, he called the first intelligence, and mother of all things; and sometimes he called her Minerva, and himself Jupiter. Simon Magus gained a great many proselytes, who paid himself and his concubine divine worship; these were the earliest heretics, and those that St John, St Peter, and St Paul, in their epistles, so often warn the Christians against.

**SIMONY**, in ecclesiastical law, the crime of buying or selling spiritual gifts or preferments. In the ancient Christian church, this crime was always thought to be committed when men either offered or received money for ordinations. The apostolical canons lay a double punishment both of deposition and excommunication on such of the clergy as were found guilty of it. This was the first sort of simony, and that which was most properly so called; and to this the ancients reduced the exacting of any reward for administering the eucharist or baptism, or for any spiritual offices. A second sort of simony consisted in buying the spiritual preferments of the church: this was punished with deposition in any bishop, who promoted any church-officer for the sake of lucre; and the persons so promoted were to be degraded from their office. By the laws of Justinian, every elector was to de-

pose upon oath, that he did not chuse the person elected for any gift or promise, or friendship, or any other cause, but only because he knew him to be a man of the true catholic faith, of unblameable life, and good learning. This last sort of simony was, when men, by ambitious arts and undue practices, got themselves invested in an office or preferment to which they had no regular call, or when they intruded themselves into other mens places which were legally filled before. The casuists for the church of Rome maintain, that all compacts or bargains in which benefices are concerned, are simoniacal, when it is done without the pope's concurrence; but that, once obtained, gives a sanction to the thing; which they found upon this universal proposition, that the pope cannot commit simony in beneficiary matters, since he hath a power so absolute over all the ecclesiastical goods and benefices, that he can unite, divide, and bestow them in whatever manner he pleases.

Against the corruption of simony, there have been many canons made in our own church, which punishes the offender with deprivation, disability, &c. and by a statute of the 31 Eliz. it is enacted, that if any person, for any sum of money, reward, gift, profit, or benefit, or by reason of any promise, agreement, grant, bond, covenant, or other assurance, shall present, or collate any person to any benefice with cure, dignity, or living ecclesiastical, every such presentation, or collation, and every admission or induction thereupon, shall be utterly void, and the crown shall present for that turn; and the person that shall give or take any sum of money, &c. shall forfeit double the value of one year's profit of any such benefice; and the person so corruptly taking any such benefice, shall from thenceforth be disabled to have and enjoy the same.

**SIMPLE**, something not mixed or compounded; in which sense, it stands opposed to compound.

**SIMPLE**, in pharmacy, a general name given to all herbs or plants, as having each its particular virtue, whereby it becomes a simple remedy.

**SIN**, a breach or transgression of some divine law, or command.

**SINAI**, a mountain of Arabia Petrea, situated east long. 35°, north lat. 29°, and memorable on account of the law's being given to the Jews on this mount.

**SINAPI**, in botany, a genus of the tetradynamia siliquosa class. The calix is open; the petals have straight ungues; and there is a nectarious gland between the short stamina and the pistillum, and between the long stamina and the calix. There are ten species, three of them natives of Britain, viz. the nigra, or common mustard; the alba, or white mustard; and the arvensis, or wild mustard.

Mustard-seed is an attenuant and resolvent in a very high degree; it warms the stomach, and excites an appetite; but its principal medicinal use is external in sinapisms, applications made to certain parts when irritation is intended, but not blistering. It is usually mixed with horse-radish root, and other ingredients of the same kind, for this purpose.

**SINAPISM**, in pharmacy, an external medicine, in form of a cataplasm, composed chiefly of mustard-seed pulverized, and mixed with the pulp of figs, or with briony, garlic, onion, or the like.

**SINCIPIUT**. in anatomy. See **ANATOMY**, p. 156.

**SINCOPORA**, a promontory of Malacca in the East Indies, situated in 2° N. lat. opposite to the island of Sumatra, with which this cape forms the straits called the Straits of Sincopora.

**SINDON**, in surgery, a little round piece of linen, silk, or lint, used in dressing a wound after trepanning.

**SINE**, or *right SINE of an arch*, is a right line drawn from one end of that arch, perpendicular to the radius drawn to the other end of the arch; being always equal to half the chord of twice the arch. See **TRIGONOMETRY**, and **GEOMETRY**.

**SINE-CURES**, ecclesiastical benefices without cure of souls.

**SINEW**, denotes what we properly call a nerve; though, in common speech, it is rather used for a tendon.

**SINGING**, the action of making divers inflections of the voice, agreeable to the ear, and correspondent to the notes of a song, or piece of melody.

**SINGULAR NUMBER**, in grammar. See **GRAMMAR**.

**SINISTER**, something on, or towards the left-hand; sinister is also used among us for unlucky, though in the sacred rites of divination the Romans frequently used it in an opposite sense.

**SINISTER**, in heraldry. The sinister side of an escutcheon is the left-hand side; the sinister chief, the left angle of the chief; the sinister base, the left-hand part of the base.

**SINISTRI**, a sect of ancient heretics, thus called, because they held the left hand in abhorrence, and made it a point of religion not to receive any thing therewith.

**SINKING FUND**, a provision made by parliament, consisting of the surplussage of other funds, intended to be appropriated to the payment of the national debts; on the credit of which very large sums have been borrowed for public uses.

**SINOPICA TERRA**, in natural history, the name of a red earth of the ochre-kind, called also rubrica sinopica, and by some authors sinopis. It is a very close, compact, and weighty earth, of a fine glowing purple colour. It is of a pure texture, but not very hard, and of an even, but dusty surface. It adheres firmly to the tongue, is perfectly fine and smooth to the touch, does not crumble easily between the fingers, and stains the hands. It melts very slowly in the mouth, and is perfectly pure and fine, and of a very austere astringent taste, and ferments very violently with aqua-fortis. It was dug in Cappadocia, and carried for sale to the city Sinope, whence it had its name. It is now found in plenty in the New-Jerseys in America, and is called by the people there blood-stone. Its fine texture and body, with its high florid colour, must make it very valuable to painters, and its powerful astringency equally so in medicine.

**SINOPLE**, in heraldry, denotes vert, or the green colour in armories.

Sinople is used to signify love, youth, beauty, rejoicing, and liberty; whence it is, that letters of grace, abolition, legitimation, &c. are always used to be sealed with green wax.

**SINUATED LEAF**, in botany. See **BOTANY**, p. 640.

**SINUOSITY**, a series of bends and turns in arches, or other irregular figures, sometimes jutting out, and sometimes falling in.

**SINUS**, in anatomy, denotes a cavity of certain bones, and other parts, the entrance whereof is narrow, and the bottom wider and more spacious.

**SINUS**, in surgery, a little cavity, or sacculus, frequently formed by a wound or ulcer, wherein pus is collected.

**SION**, a town of Switzerland, in the county of Valais, situated on the river Rhone, twenty-three miles south-east of the lake of Geneva, being a sovereign state.

**SIPHON**, a bended pipe, one end of which being put into a vessel of liquor, and the other hanging out of the said vessel over another, the liquor will run out from the first into the last, after the air has been sucked out of the external or lower end of the siphon, and that as long as the liquor in the upper vessel is above the upper orifice of the siphon.

**SIPHONANTHUS**, a genus of the tetrandria monogynia class. The corolla consists of one funnel-shaped petal, with eight segments; and there are two berries containing many seeds. There is but one species, a native of India.

**SIRANAGER**, a city of hither India, capital of the province of Siba, situated on the river Ganges: E. long. 80°, N. lat. 31° 30'.

**SIRE**, a title of honour in France, now given to the king only, as a mark of sovereignty.

**SIREN**, in antiquity, a kind of fabulous animal, otherwise called a mermaid.

The sirens are represented by Ovid, &c. as sea-monsters, with womens faces and fishes tail; and by others decked with plumage of various colours. The three sirens are supposed to be the three daughters of the river Achelous; and are called Parthenope, Ligea, and Leucosia. Homer makes mention of only two sirens, and some others reckon five. Virgil places them on rocks where vessels are in danger of splitting. Some represent them as such charming monsters, who sung so harmoniously, that sailors were wrecked on their rocks without regret, and even expired in raptures.

**SIREN**, in zoology, a genus belonging to the order of amphibia meantes. The body is naked, and furnished with two unguiculated feet, and a tail. It has a great resemblance to a lizard, only it is larger. It is found in marshy grounds in Carolina.

**SIRIUS**, in astronomy, a bright star in the constellation canis. See **ASTRONOMY**, p. 487.

**SISON**, in botany, a genus of the pentandria digynia class. The fruit is oval and striated; and the involucre consists of four leaves. There are six species, three of them natives of Britain, viz. the amomum, or balsard stone-parsley; the segetum, or corn-parsley; and the inundatum, or least water-parsnep. The seed of the amomum is one of the four lesser hot seeds of the Mops; and is an attenuant, aperient, and carminative.

**SISYMBRIUM**, in botany, a genus of the tetradynamia siliquosa class. The pod opens with straight valves; and the calix and corolla are open. The species are 25, seven of them natives of Britain. The young leaves of the cordamine, or ladies-smoke, and of the nostrurtium, or water-crests, are recommended in the scurvy, and eaten in large quantities for that intention with great success.

**SISYRINCHIUM**, in botany, a genus of the gynandria triandria class. The spathe consists of two leaves, and the corolla of six petals; and the capsule has three cells. There is but one species, a native of Virginia.

**SITE**, denotes the situation of an house, &c. and some-

times the ground-plot, or spot of earth it stands on.

**SITOPHYLAX**, in Grecian antiquity, an Athenian magistrate, who had the superintendance of the corn, and was to take care that nobody bought more than was necessary for the provision of his family.

**SITTA**, in ornithology, a genus belonging to the order of picæ. The bill is subulated, cylindrical, straight, and entire; the superior mandible being longer than the inferior, and compressed at the point; the tongue is lacerated; and the nostrils are covered with hairs. There are three species, distinguished by their colour.

**SIUM**, in botany, a genus of the pentandria digynia class. The fruit is somewhat oval, and striated; the involucre consists of many leaves; and the petals are heart-shaped. There are 8 species, three of them natives of Britain, viz. the lautolium, or great water-parsnep; the nodiflorum, or creeping water-parsnep; and the erectum, or upright water-parsnep.

**SIXTH**, in musick, one of the simple original concords, or harmonical intervals. See **MUSICK**.

**SIZE**, the name of an instrument used for finding the bigness of fine round pearls. It consists of thin pieces or leaves, about two inches long and half an inch broad, fastened together at one end by a rivet. In each of these are round holes drilled of different diameters. Those in the first leaf serve for measuring pearls from half a grain to seven grains; those of the second, for pearls from eight grains, or two carats, to five carats, &c. and those of the third, for pearls from six carats and a half to eight carats and a half.

**SIZE** is also a sort of paint, varnish, or glue, used by painters, &c.

The shreds and parings of leather, parchment, or vellum, being boiled in water and strained, make size. This substance is used in many trades.

The manner of using size is to melt some of it over a gentle fire; and scraping as much whiting into it as may only colour it, let them be well incorporated together; after which you may whiten frames, &c. with it. After it dries, melt the size again, and put more whiting, and whiten the frames, &c. seven or eight times, letting it dry between each time: but before it is quite dry, between each washing, you must smooth and wet it over with a clean brush-pencil in fair water.

To make gold-size, take gum animi and asphaltum, of each one ounce; minium, litharge of gold, and amber, of each half an ounce; reduce all into a very fine powder, and add to them four ounces of linseed-oil, and eight ounces of drying-oil; digest them over a gentle fire that does not flame, so that the mixture may only simmer, but not boil; for fear it should run over and set the house a-fire, keep it constantly stirring with a stick till all the ingredients are dissolved and incorporated, and do not leave off stirring it till it becomes thick and ropy; and being boiled enough, let it stand till it is almost cold, and then strain it through a coarse linen-cloth and keep it for use.

To prepare it for working, put what quantity you may have occasion to use in a horse-muscle shell, adding so much oil of turpentine as will dissolve it; and making it as thin as the bottom of your seed-lac varnish, hold it over a candle, and then strain it through a linen rag into another shell; add to these so much vermilion as will

make it of a darkish-red : if it is too thick for drawing, you may thin it with some oil of turpentine. The chief use of this size is for laying on metals.

The best gold-size for burnishing is made as follows : take fine bole, what quantity you please ; grind it finely on a marble ; then scrape into it a little beef-suet ; grind all well together ; after which mix a small proportion of parchment size with a double proportion of water, and it is done.

To make silver-size : take tobacco-pipe clay, in fine powder ; into which scrape some black-lead and a little Genoa-soap ; and grind them all together with parchment-size, as already directed.

SKAITE, in ichthyology. See RATA.

SKIFLETON, in anatomy. See ANATOMY, p. 151.

SKIE one of the greatest western islands of Scotland, divided from the counties of Ross and Inverness by a narrow channel ; being upwards of sixty miles in length and twenty in breadth.

SKIFF, the least of two ship-boats, serving chiefly to go ashore in, when the ship is in harbour.

SKIN, in anatomy. See ANATOMY, p. 254.

SKIN in commerce, is particularly used for the membrane stripped off the animal to be prepared by the tanner, skinner, currier, parchment-maker, &c. and converted into leather, &c. See TANNING, &c.

Skins and the hair of beasts manufactured become parchment and vellum ; leather, of which are made shoes and boots, saddles, harnesses, and furniture for horses, gloves and garments, coaches and chairs, household stuff, covers of books, drinking vessels, &c. and furs for cloathing, hats, caps, &c.

SKINNER, one who works in skins. See SKIN.

SKIPTON, a town in the west riding of Yorkshire, situated thirty five miles west of York.

SKIRMISH, in war, a disorderly kind of combat, or encounter, in presence of two armies, between small parties, or persons, who advance from the body for that purpose, and introduce to a general and regular fight.

SKULL, in anatomy. See ANATOMY, p. 151.

SKY, the blue expanse of air and atmosphere.

The azure colour of the sky Sir Isaac Newton attributes to vapours beginning to condense there, and which have got consistence enough to reflect the most reflexible rays.

SLAB, an outside sappy plank or board sawed off from the sides of a timber-tree : the word is also used for a flat piece of marble.

SLATE, a stone of a compact texture and laminated structure, splitting into fine plates

Dr Hill distinguishes four species of slate stegania : 1. The whitish steganium, being a soft, friable, slaty stone, of a tolerably fine and close texture, considerably heavy, perfectly dull and destitute of brightness, variegated with a pale brown, or brownish yellow : this species is very common in many counties in England, lying near the surface of the ground ; it is generally very full of perpendicular as well as horizontal cavities, many of which are filled up with a spar a little purer and more crystalline than the rest, and is commonly used for covering houses. 2. The red steganium is a very fine and elegant slate, of a smooth surface, firm and compact texture, considerably heavy, and of a very beautiful pale purple, glittering all over with small glossy spangles : it is com-

posed of a multitude of very thin plates or flakes, laid closely and evenly over one another, and cohering pretty firmly : this is very common in the northern parts of England, and is much valued as a strong and beautiful covering for houses. 3. The common blue steganium is very well known, as an useful and valuable stone, of a fine smooth texture and glossy surface, moderately heavy, and of a pale greyish blue ; composed of a multitude of even plates, laid close upon one another, and easily splitting at the commissures of them : this is also very common in the north parts of England, and is used in most places for the covering of houses. There are other species of this slate, viz. The brownish blue friable steganium, usually called coal slate ; the greyish black friable steganium, commonly called shiver ; and the greyish blue sparkling steganium. 4. The friable, aluminous, black steganium, being the Irish slate of the shops : this is composed of a multitude of thin flakes, laid very evenly and regularly over one another, and splits very readily at the commissures of them. It is common in many parts of Ireland, and is found in some places in England, always lying near the surface in very thick strata. In medicine, it is used in hæmorrhages of all kinds with success, and is taken often as a good medicine in fevers.

There is a sort of slate-stones called, by Dr Hill, ammoschista. Of this kind there are only two species : 1. That composed only of sparry and crystalline particles ; or the grey, friable, dull ammoschistum ; being a coarse, harsh, and rough stone, of a very loose texture, considerably heavy ; and composed of a large, coarse, obtusely angular gritt, surrounded, and in part held together, by a loose earthy spar. This stone is very common in most countries, and is frequently used to cover houses, instead of tiles : it bears the weather but badly, and is apt to crumble after frosts. 2. That composed of talcy, sparry, and crystalline particles. This comprehends five species, viz. the brownish white glittering ammoschistum ; the greenish grey shining ammoschistum ; the yellowish grey glittering ammoschistum ; the hard purple and white laminated ammoschistum ; and the bluish glittering slate stone. These sorts of slate-stone are very common in the northern countries, and are used in covering houses, paving, building, &c.

SLAVE, a person in the absolute power of a master, either by war or conquest. We find no mention of slaves before the deluge : but immediately after, viz. in the curse of Canaan : whence it is easily inferred, that servitude increased soon after that time ; for in Abraham's time we find it generally established.

Among the Romans, when a slave was set at liberty, he changed his name into a surname, and took the name or prenomer of his master ; to which he added the cognomen he had been called by when a slave. Great part of the Roman wealth consisted in slaves : they had the power of life and death over them, which no other nation had ; but this severity was afterwards moderated by the laws of the emperors. The slaves were esteemed the proper goods of their masters, and all they got belonged to them ; but if the master was too cruel in his correction, he was obliged to sell his slave at a moderate price.

Slavery is absolutely abolished in Britain and France, as to personal servitude. Slaves make a considerable article.

ticle of the traffick in America. The British south-sea company have, by treaty, the sole privilege of furnishing the Spanish West Indies with slaves.

**SLAUGHTER.** See **MANSLAUGHTER**, **HOMICIDE**, **MURDER**, &c.

**SLEDGE**, a kind of carriage without wheels, for the conveyance of very weighty things, as huge stones, &c.

**SLEEP**, is defined to be that state wherein the body appearing perfectly at rest, external objects move the organs of sense as usual, without exciting the usual sensations.

Sleep is broken off unnaturally, when any of the organs of sensation is so briskly acted on, that the action is propagated to the brain.

Sleep being one of the non-naturals, it is not possible for those to preserve their health, who do not go to sleep in a regular manner: for sleep repairs the spirits, which are dissipated by watching; and consequently it restores the strength of those who are weak, indisposed, or labour much. It likewise promotes perspiration, contributes greatly to digestion, and more to nutrition. The night is the most proper for sleep; for the vigour of the mind and body are better restored in the night than in the day; thus nocturnal labour and lucubrations impair the health.

**SLEEPER**, or the **GREAT SLEEPER**, in zoology. See **MUS**.

**SLEEPERS**, in natural history, a name given to some animals which are said to sleep all the winter; such as bears, marmotes dormice, bats, hedge hogs, swallows, &c. These do not feed in winter, have no sensible evacuations, breathe little or not at all, and most of the viscera cease from their functions. Some of these creatures seem to be dead, and others to return to a state like that of the fœtus before the birth: in this condition they continue, till by length of time maturing the process, or by new heat, the fluids are attenuated, the solids stimulated, and the functions begin where they left off.

**SLEEPERS**, in the glass-trade, are the large iron-bars crossing the smaller ones, and hindering the passage of the coals, but leaving room for the ashes.

**SLEEPERS**, in a ship, timbers lying before and aft, in the bottom of the ship, as the rung-heads do: the lowermost of them is bolted to the rung-heads, and the uppermost to the futtocks and rungs.

**SLESWICK**, the capital of the duchy of Sleswick, otherwise called South Jutland, situated on the river Sley: E. long 9° 45', and N. lat. 54° 45'. See **JUTLAND**.

**SLIDING**, in mechanics, is when the same point of a body, moving along a surface, describes a line on that surface.

**SLIGO**, a county of Ireland, in the province of Connaught, bounded by the ocean on the north, by Letrim on the east, by Roscommon on the south, and by Mayo on the west.

**SLING**, an instrument serving for casting stones with great violence. The inhabitants of the Balearic islands were famous in antiquity for the dexterous management of the sling: it is said they bore three kinds of slings, some longer, others shorter, which they used according as their enemies were either nearer or more remote. It is added, that the first served them for a head-band, the se-

cond for a girdle, and that a third they constantly carried with them in the hand.

**SLIPPING**, among gardeners, the tearing off a sprig from a branch, or a branch from an arm of the tree.

These sort of slips take root more readily than cuttings.

**SLOANEA**, in botany, a genus of the polyandria monogynia class. The corolla consists of five petals. and the calix of five deciduous leaves; the stigma is perforated; and the berry contains many seeds.

**SLOATH**, in zoology. See **BRADYPUS**.

**SLOE**. See **PRUNUS**.

**SLOOP**, a sort of floating vessel, otherwise called shallop. In our navy, sloops are tenders on the men of war, and are usually of about sixty tons, and carry about thirty men.

**SLOUGH** a deep muddy place. The cast skin of a snake, the damp of a coal-pit, and the scar of a wound, are also called by the same appellation. The slough of a wild boar, is the bed, soil, or mire, wherein he wallows, or in which he lies in the day-time.

**SLUCZK**, the capital of the palatinate of the same name, in the duchy of Lithuania and kingdom of Poland: situated in E. long 27°, and N. lat. 53°.

**SLUICE**, in hydraulics, a frame of timber, stone, earth, &c. serving to retain and raise the water of the sea, a river, &c. and on occasion to let it pass: such is the sluice of a mill, which stops and collects the water of a rivulet, &c. in order to discharge it at length in greater plenty upon the mill-wheel; such also are those used in drains, to discharge water off lands; and such are the sluices of Flanders, &c. which serve to prevent the waters of the sea overflowing the lower lands, except when there is occasion to drown them. See **CANAL**.

**SLUTTELBURG**, a town of Russia, in the province of Ingria, situated on the south-side of the lake Ladogo, in E. long. 31° 20', N. lat. 60°.

**SLUYS**, a port-town of Dutch Flanders, situate opposite to the island of Cadfant: E. long 3° 15', N. lat. 51° 18'.

**SMACK**, a small vessel with but one mast.

**SMALAND**, a province in Sweden, in the territory of Gothland, bounded by East Gothland, on the north: by the Baltic sea, on the east; by Blecking, on the south; and by Halland, on the west

**SMALLAGE**, in botany. See **APIUM**.

**SMALT**, a preparation of arsenic. See **CHEMISTRY**, p: 145.

**SMARAGDUS**, in natural history. See **EMERALD**.

**SMARIS**, in ichthyology. See **SPARUS**.

**SMELL**, with regard to the organ, is an impression made on the nose, by little particles continually exhaling from odorous bodies: with regard to the object, it is the figure and disposition of odorous effluvia, which striking on the organ, excite the sense of smelling: and with regard to the soul, it is the perception of the impression of the object on the organ, or the affection in the soul resulting therefrom.

The principal organs of smelling are the nostrils, and the olfactory nerves; the minute ramifications of which latter are described throughout the whole concave of the former. See **ANATOMY**, p. 293.

**SMELT**, in ichthyology, a species of salmo, See **SALMO**.

**SMELTING**, in metallurgy, the fusion or melting of the ores of metals, in order to separate the metalline part from

from the earthy, stony, and other parts. See CHEMISTRY, *passim*.

SMILAX, in botany, a genus of the d'œcia hexandria class. The calix both of male and female consists of six leaves; none of them have any corolla; the stylus of the female is trifid; and the berry has three cells, containing two seeds. There are 13 species, none of them natives of Britain.

SMITHERY, a manual art, by which an irregular lump of iron is wrought into any intended shape, by means of fire, hammering, filing, &c.

SMOKE, a dense elastic vapour, arising from burning bodies. As this vapour is extremely disagreeable to the senses, and often prejudicial to the health, mankind have fallen upon several contrivances to enjoy the benefit of fire, without being annoyed by smoke. The most universal of these contrivances is a tube leading from the chamber in which the fire is kindled, to the top of the building, through which the smoke ascends, and is dispersed into the atmosphere. These tubes are called chimneys; which, when constructed in a proper manner, carry off the smoke entirely; but, when improperly constructed, they carry off the smoke imperfectly, to the great annoyance of the inhabitants. As our mansions at present seem to have a very imperfect knowledge of the manner in which chimneys ought to be built, we can hardly perform a more acceptable service to the public than to point out the manner in which they ought to be constructed so as to carry off the smoke entirely; as well as to explain the causes from which the defects so often complained of generally proceed, and the method of removing them.

Although we would naturally imagine, that the causes which occasion smoke in rooms are exceedingly various; yet, upon examination, it will be found that they may all be reduced to one of these three general heads, each of which will admit of several varieties.

I. To a fault in the form of the tube, or chimney itself.

II. To some fault in the other parts of the building, and a wrong position of the chimney with respect to these.

III. To an improper situation of the house with respect to external objects. And it is of the utmost consequence, in attempting a cure, accurately to distinguish from which of these defects the smoke proceeds, it will be necessary to point out with care the several phenomena which are peculiar to each.

I. Of smoke occasioned by a fault in the form of the chimney itself. But, before we proceed, it will be necessary to premise something with regard to the general cause of the ascent of smoke in chimneys.

The earth is every where surrounded with a great body of air, called the atmosphere. This air is an elastic fluid subjected to many particular laws, as hath been fully explained under the article PNEUMATICS; where it hath been sufficiently demonstrated, that, like other fluids, it hath a constant tendency to preserve an equilibrium in all its parts; so that, if at any time the weight of it at one place is diminished, the heavier air rushes from all sides towards that point, till the equilibrium be again restored. We there likewise saw, that heat was one of the most powerful means of disturbing this general equilibrium of the air, by expanding it to a great degree, and making the same quantity

occupy a much greater space than before, and consequently become lighter. Hence it necessarily follows, that where-ever a fire is kindled, the air immediately contiguous to it will be heated, and of consequence rarified and made light; which must ascend into the higher regions of the atmosphere, till it becomes of the same gravity with the air contiguous to it; while the denser cold air below rushes toward the point from which it departed, is there heated and rarified in its turn, and ascends in the same manner, carrying the smoke or vapour arising from the burning body along with it. In this manner that constant suction of air towards every fire is produced, and from this cause proceeds the constant tendency of smoke to ascend upwards from the surface of the earth. But as the body of our atmosphere is often agitated with wind, &c. and as it is an elastic fluid, it endeavours to spread itself every way; from which causes the warm air would quickly be diffused among the cold air before it could arise to any considerable height; so that the smoke would always remain low, and be tossed about near the surface of the earth: all of which inconveniencies are avoided by confining this heated air in a tube, which prevents it from mixing with the external air, till it arrive at the height to which we desire it should ascend.

To render this still more clear, see Plate CLVI. where AB (fig. 1.) represents the tube of a chimney, having a fire at the bottom at A. It is obvious, that, in this situation, the air which was heated by the fire at A, will ascend directly upwards, without mixing with the external air, till it arrives at B, beyond which it will be at liberty to disperse in the atmosphere; and the more weighty air which presses in to supply its place can have no access to it but at the opening between A and E, where it also is heated by the fire, and in its turn ascends to the top of the chimney, thereby occasioning a constant stream of air to ascend up the chimney, which carries the smoke along with it. This is the manner in which fuliginous vapours are made to ascend in chimneys; and by attending to it, we may draw the following corollaries with regard to the construction of this useful part of our habitations.

1st, The higher the chimney, that is, the greater the distance between the fire-place and the top of the chimney, the greater will be the difference between the weight of the column of heated air in the tube, and another column of the atmosphere of the same diameter without the chimney, and consequently the air will enter with the greater force at the opening AE, and carry up the smoke more readily along with it: for as the warm air within the tube continues rarified to a high degree till it issues from the top of the chimney, and is, in every part of its length, lighter than the same bulk of external air marked by the dotted line CD, it follows, that the longer these two columns of unequal gravity are, the greater must be the difference of their weight. Hence it is, that high chimneys (*cæteris paribus*) have a greater suction of air, and are less liable to vent ill, than low ones. A smoky chimney may therefore sometimes be cured by raising it higher. It is likewise obvious, that if any opening is made into the chimney, as at F, the air will enter with less force at E, and carry up the smoke with less velocity, and by that means be in danger of producing smoke in the room; for this opening, as it admits the fresh air into the tube, has nearly the same effect as shortening the tube so much would have.

2d, As the smoke is forced up the chimney merely by the rarefaction

rarefaction of the air in consequence of heat, it is evident, that the more the air is heated, with the greater force (*ceteris paribus*) will it ascend, because the difference between the weight of the external and internal air will be greater; and as the air will be the more heated the nearer it is made to pass by the fire in its entry into the chimney, it is evident, that the smaller the opening at AE is, or, in other words, the lower the mantle of the chimney is, the air will be forced to pass the nearer the fire, and therefore be more rarefied, and ascend with the greater velocity; so that lowering the mantle of the chimney will often cure smoke.

But it is frequently inconvenient to have the mantle of the chimney too low. However, the same effect may often be produced by another contrivance. For as the fire-place is usually made wider than the length of the grate, a great deal of cool air passes at the two sides of the grate without being much heated. This greatly diminishes the suction of the chimney: but it may easily be prevented by building up the vacancies at each side of the grate, so as to allow no air to enter from below, except what comes immediately through, or before the fire. For this purpose, grates consisting of a neat hewed stone at each end, with a breast and bottom of iron fitted to them, as represented at fig. 2. are extremely convenient. But the aperture of the chimney is often not suddenly contracted above the mantle, but goes up tapering slowly, as in the same fig. 2. This structure allows a quantity of cool air to enter at the two corners of the mantle, and steal up the tube without coming near the fire. The most easy and effectual method of remedying this defect, is to place a sheet of milled iron within the mantle on each side, as low down as possible, making them slant a little upwards towards the middle of the chimney; as at A, fig. 2. the mantle being represented by the dotted line. By this contrivance, the air, which enters at the side of the mantle, before it can ascend into the chimney, is forced to pass very near the fire, and of course is much rarified. The good effects of this would be still more strongly felt, if one of these plates were placed a little lower than the other, and made so long, that the ends should cross each other, as at AB, fig. 2. by which means every particle of air that went up the chimney behaved to pass immediately above the fire. It is almost unnecessary to observe, that these plates ought to be so contrived as to be taken out at pleasure to allow the chimney to be cleaned.

A chimney may not only be defective by having the mantle too high, or by being too wide from side to side, but also by being too deep between the fore side and the back, as is often the case in very old houses. In this case, the distance between the fire and the mantle is so great, that much air passes up without being sufficiently rarified, as is represented at fig. 3. This may be sometimes cured by bringing the grate a little forward, which, by making the fire act more powerfully upon the mantle, rarifies the air more in its passage. But this can seldom produce the desired effect, and it often does harm: for when the grate is brought forward, there is a great vacancy left between it and the back of the chimney, so that the air passes under the grate, and ascends behind it very little rarified; so that, if the feet of grate are not very low, there will be as much lost in this way as will be gained in the other; and as there is not enough of heated air in the chimneys of this kind to make the vapour ascend with rapidity, they are often choaked with thick fuliginous vapours hanging in them, almost in equi-

librio with the rest of the atmosphere, so that the least puff of wind beats them down the chimney, and pushes the smoke into the room; whereas, when it is far back, it is driven down upon the hearth, and rises upwards again when the gulf is over, and a great deal of it is caught within the mantle as it rises, which in the other case would have been dispersed through the room. When this is the case, the most effectual method of cure is, to bring the grate forward till the forepart of it is immediately under the inner edge of the mantle; then build up the vacancy at the back of it, the whole width of the fire-place from side to side, raising it perpendicularly till it is as high as the back of the grate, and then bending it forward towards the mantle, as is represented at fig. 4. When it is as high as the workman can reach, let it be suddenly turned backward again, sloping a little upward, as in the figure; then fit a sheet of milled iron to the inside of the mantle, making it slant a little upward toward the back part, at a small distance above the new erected masonry, and extending within a few inches of the back wall, as at A, fig. 4. By this construction all the air that enters into the chimney is made to pass immediately above the fire, between it and the heated iron, upon which the flame acts with the greater force, as the back of the fire-place is bent a little forward above the grate, and the heat is likewise reflected into the room with the greater force: at the same time, if the smoke is at any time beat down the chimney by a sudden gust of wind, it will be caught by the sheet of iron, and prevented from coming into the room. If the fire-place be very wide between the one side and the other, the new masonry may be carried quite up to the sheet of iron on each of the sides.

3d, As every fire requires a constant succession of fresh air, the tube for conveying this rarefied air to the higher regions of the atmosphere must be of a sufficient size to contain the whole of it, and allow it a ready passage; otherwise a part of it will be forced to seek some other passage; by which means, the apartment in which the fire is placed will be constantly filled with smoke. Every chimney therefore ought to have a degree of wideness sufficient to carry off the whole of the smoke arising from the fire usually burnt in it, otherwise the apartment will be almost continually filled with smoke.—This is a fault more common at present than any of those already mentioned, especially in large towns, where the number of chimneys in one wall is often so great that it is difficult to get a sufficient space for each. The most obvious cure, where the situation admits of it, is to widen the chimney, by opening a hole a little above the grate thro' the back-wall of the chimney, slanting a little upward, and building on the outside of the wall a small chimney open from that hole to the top of the building, as in fig. 5. where AB represents the new tube going through the wall at the opening at A, which will receive the superfluous smoke, and carry it off. This additional chimney must always be carried as high as the other. But as there are many situations in which this method of cure would be impracticable, we must try every method for accelerating the ascent of the smoke; (for the more quickly it ascends, the more narrow may the tube be;) and with that view, the chimney may be heightened at top, and contracted at bottom, in any or all the various ways we have mentioned. But if none of these methods prove effectual, let the chimney be built quite close at the under part, leaving only as much room as is sufficient to contain the grate, having a cover of metal fitted to that opening

pening, which can be taken off or put on at pleasure; by which the whole air that enters into the chimney is made to pass through the fire like a furnace, and carries the smoke up it with great velocity. These are well known in large towns by the name *smoke chimneys*: but as they occasion a prodigious waste of fuel without warming the room, and, unless attended with very great care, are in danger of setting the building on fire, they ought to be as much avoided as possible. But if neither this, nor any of the other methods prove effectual, the wall must either be taken down and rebuilt in a proper manner, or the chimney abandoned as incurable. As this is a defect more difficult to be remedied than any other, we would strongly recommend it to every builder to build his chimneys of a sufficient width throughout; there is no danger of erring on this extreme, as it is easy to remedy any defect that might arise from it.

4th, As the air which ascends through the chimney continues nearly of an equal degree of heat to the top, the tube should be of an equal degree of width at the top as at the bottom, as well as through the whole of its length. It ought not therefore to be made tapering gradually from the fire-place to the top, but to be suddenly contracted above the grate, as in fig. 6. from which it ought to be continued of an equal wideness throughout its whole length: but if it is narrower at any one place than another, it ought to be at the under part, immediately above the fire, for a very short space; because, as this is within reach of the hand, the foot can be cleaned from it as often as is necessary, so that when the other parts of the chimney are full and clogged with soot, they will not be narrower than this place is at that time.

5th, It seldom happens that a chimney can be carried quite straight upwards: and it is an advantage that it is so, as they ought always to be bent a little. For if a chimney be straight, and of a proper width to transmit the whole of the smoke and no more, it will not be sufficient for that purpose, when there is a heavy fall of rain, or snow, or hail, with little wind; for the great drops will fall perpendicularly from the top to the bottom of the chimney, and as they occupy a considerable space, the smoke will not have room to ascend, but must be forced down with the shower, and dispersed in the apartment: whereas, if the chimney is bent, the rain falls upon some of the sides, and glides gently down without disturbing the ascent of the smoke. The same inconvenience will be felt in a straight chimney, where it is so placed as to be exposed to winds which sometimes enter the top and blow down with a sudden puff: for, if it be straight, the air meets with no interruption till it descends into the chamber, and there disperses the smoke; but if it be crooked, the descent of the wind will be obstructed its force broken, and the bad effects of it in a great measure prevented. Upon the whole, bent chimneys are always preferable to straight ones. However, a perpendicular chimney may be easily cured, by some of the contrivances after mentioned.

These are the most general defects arising from the structure of the chimney itself, which are all reducible to the following causes: 1. Too little height; 2. Too great wideness of the bottom of the chimney; 3. Too little width; 4. Unequal wideness between the top and bottom; and, 5. Straightness of the tube. We have pointed out the best methods of curing each of these defects; and to fi-

nish our remarks on this general head, and give the reader a more perfect idea of the best form of construction for a chimney, we have drawn two different sections of one constructed on the justest principles, in figures 6. and 7. the several parts of which appear so plain from the figures, and the reasons for this construction have been already so clearly assigned, that a very short explanation will be sufficient. Figure 6. represents a front-view of the fire-place; supposing the fore-part of the wall taken down, and the chimney laid bare from top to bottom; AB, and DC, representing the two sides of the fire-place; and BC, the mantle, being cut through, to shew the manner in which the aperture is suddenly contracted, immediately above the fire within the mantle. The tube from the point E, to the top, ought to be of an equal wideness, and bent in any direction that may be convenient. The two planes, FF, represent the two sides of the fire-place, which ought to be as much sloped inward towards the back as the form of the grate will admit of; for the more they are inclined, the more powerfully will they reflect the heat into the apartment. Fig. 7. represents a perpendicular section of the wall, through the middle of the chimney, to discover its shape, if viewed from a side. And here it is to be observed, that it ought ever to be a rule to bring the building at the under part of the chimney immediately behind the grate, as far forward as possible, because this throws more heat into the chamber than if it were placed farther back: but as the fore-part of the grate ought never to project beyond the inner edge of the mantle, care should be taken to have the under part of the mantle wrought as thin as the nature of the materials will admit of, making it thicker towards the upper part, so as to slope upwards above the fire, as represented at B, fig. 7. To throw the heat outward, let the upper part of the back of the fire-place be a little inclined outward, as at C; but, after it is carried up in this manner a little higher than the mantle, let it be suddenly turned back, as in the figure, the projection above the mantle inclining backward in the same direction, being carried up to the top at an equal wideness the whole way.

Although it is necessary to have all chimneys pretty wide; yet this, on many occasions, is attended with inconveniences: for as they transmit a great quantity of heated air, too large a portion of that warm air which ought to heat the chamber is carried off; and as it is only when the fire is first kindled that the great quantity of gross vapour is exhaled which fills the chimney, and maketh a large tube necessary, if it were so contrived as to contract or dilate at pleasure, we might have our chimney of a sufficient width to convey away the greatest quantity of smoke that could ever have occasion to pass through it, at the same time that we might never allow more air to pass off at other times than was necessary to carry away the whole of the smoke, by which means a much smaller quantity of fuel would keep our apartment equally warm. This we apprehend might be accomplished by the following simple apparatus. Let a sheet of milled iron be fixed at the upper part of the mantle, on the inside, at B, in such a manner, as that, by means of a small wire *de*, passing through a small hole left for that purpose in the fore-part of the chimney, it might be let down at pleasure towards C, or drawn up towards B, so as to apply quite close to the upper edge of the chimney between B and C. This would leave the tube of its

its full wideness when necessary, or close it to any degree at pleasure, with the greatest ease \*. It is unnecessary to add, that the plate at A fig. 4. might be employed in the same manner, when it should be found convenient. So much for what relates to the construction of the chimney itself. We now proceed to consider the second general cause of smoke, viz.

II. Of smoky houses proceeding from faults of other parts of the building, altogether independent of the structure of the chimney itself.

1st, The first we shall mention is too great closeness of the room. Smoke, as shewn above, is impelled up the chimney by the pressure of the air entering at the fire-place and ascending upwards; but, if fresh air is not admitted into the apartment in sufficient quantities to supply the consumption by the fire, the room will be quickly exhausted, and the air in it become as light as the external air at the top of the chimney, so that the smoke will as readily be dispersed into the chamber as through the chimney. But if any door or window is opened so as to admit plenty of free air, the smoke will be quickly dispelled, and the proper circulation established: the same effect will be produced by making a small hole in some of the sides of the room; but unless this be done with some judgment, it may frequently add to the disease, as it may concur with some of the other causes of smoky houses, to be afterwards mentioned. A better method of remedying this evil would be to have a small hole made in the wall at the back of the chimney, and immediately underneath it: or a small perforation, made in the wall in any other convenient manner; the one end of which should communicate with the external air, and the other communicate with the chamber in any place near the grate, and as low down as possible, through which a constant supply of air would be administered to the fire without the smallest inconvenience or trouble. If this were practised, doors and windows might with safety be made much closer than at present, and our apartments rendered equally warm and comfortable with a much smaller quantity of fuel than we use at present. For as the fire, in the present mode of constructing chambers, is kept alive by a constant succession of cold air from the doors, windows, and other crannies of the room rushing towards the chimney in all directions, the air of the room, which, if not cooled by this means, would be quickly heated to a great degree, is constantly kept cold in spite of the strong heat of a blazing fire; which, at the same time that it scorches the parts of our body which are most exposed to it, does not warm the parts which are turned from it; and we experience at the same time a burning heat and piercing cold, which is often productive of the most disagreeable effects. But if the fire were supplied with air in the manner abovementioned, there would be less air drawn in through the crannies of the room,

so that the air within would be soon warmed, and continue long so even with a small degree of heat. However improper this might be for people in perfect health, it might surely be of great use for those who are in a weakly habit of body; especially if care were taken to carry off the foul air, by having a small tube leading from the upper part of the room to the top of the house, through which the air which had been rendered noxious by the smoke of candles or perspiration would be conveyed away, and a succession of fresh air admitted from the tube near the fire-place to supply that want. That the reader may more readily comprehend what is here meant, we have represented in fig. 6. a view of two small tubes for this purpose supposed to be laid open by taking away the boxing or inner coating of the wall which ought to cover them. These are of wood, and must not be above one inch in diameter. One end, *g g*, goes quite through the outer wall of the house, and communicates with the open air, having a small grate upon it to prevent vermin from entering. The other end, *h h*, passes behind the two slabs at the side of the fire-place, and open in the inside of the fire-place at *i i*, at which place they have each of them a small bit of brass fitted to them, being closed with two sliding doors exactly like those that are used to cover the end of telescopes, by means of which more or less air may be admitted at pleasure.

2d, A second cause of smoke, is the wrong position of doors and windows, with respect to the fire-places.

As the smoke is impelled up the chimney by the pressure of the air, if that air is driven away from the fire-place by any cause more powerful than the suction occasioned by the fire, the smoke must also be drawn away with it, and follow the same directions with that current of air; so that whatever tends to draw a current of air from the under part of the chimney, will also tend to produce smoke in the house; from whence it is easy to conceive how doors or windows may occasion smoke when the wind is in certain directions. Thus, suppose a chamber, A, B, C, D, fig. 8. having a door or window at E, another at F, and a fire-place at G; when the wind is in the direction D A or C B, the general current of air will occasion a sort of suction at the opening E, so that the air will be drawn from the chimney G towards E: and if the current be strong, and the opening at E large, it will become more powerful than the suction of the chimney, and produce smoke in the apartment. If the window at F should be opened in this case, it would not mend the matter; for any wind which should enter at F, would be carried straight out at the opening E, and the current of air would be drawn from the chimney as strong as ever. If the window at E were shut, and that at F left open, and the wind still continued in the same direction as before, the current of air rushing past the window would have a tendency to draw the air of the room along with it,

\* If any one should think, that the wire *d* would be a disagreeable object in the middle of a chimney-piece, it might easily be hid by a picture of any kind. The wire might be fixed to a small brass-handle moving freely upward and downward like that for a bell; only this should have a long slit in the middle of it, with notches on each side, to receive a pin placed in the middle of the slit, by means of which the wire might be lengthened or shortened at pleasure. The whole of this apparatus is represented at fig. 16. where (*a*) represents the wire fastened to the brass-plate; (*b*) a piece of brass, raised a little, to serve as a handle. The slit in the middle is represented by the dark line, having notches *ccc* at convenient distances. The pin *d* is fixed into the wall, but left at liberty to turn about with ease; and its head stands up a little, so as to be easily turned with the finger and thumb. The body of this nail is made so thin in one direction, that when it is turned half round, it easily passes through the slit in the plate; but in the other direction its diameter is greater, so that when the plate is brought so as to have one of the notches opposite to the nail, and it is then turned half round, it catches the plate so that it cannot be moved till the nail is again turned about.

and occasion smoke, but not so powerfully as if the window at E were open; but if the wind were in the direction D B, it would be very bad: but if it blew in the direction C A, the case would be very much altered; for then a quantity of air being forced in at the opening F, and finding no ready passage, it would be pent up in the chamber, and force itself up the chimney with violence. We omit mentioning what would be the effect if the wind were in other directions, as it is imagined these will be sufficiently obvious to every attentive observer. It is only necessary here to observe, that as doors or windows are seldom so exactly made, but they produce some effect, as they always admit some air even when shut, and often occasion smoke when the wind blows from a particular quarter; and as workmen and others generally apprehend, when houses are troubled with smoke in this manner, that it is occasioned by some external cause, and apply their attention to cure it by altering the top of the chimney, which never can produce the smallest service in this case; we would recommend a more particular attention to be paid to the situation of doors and windows than is generally bestowed; especially in such situations where they are exposed to any violent current of air in a particular direction, as in narrow lanes, or defiles of any sort, where the wind, when in particular directions, is hurried along with a prodigious rapidity. And, that the effects of different positions may be still more obvious, we shall produce several other examples.

Suppose a chamber, fig. 9. having a door at A, and two windows B C, with a fire place D. If the wind came in the direction DA, and if the door transmitted as much or more air than was admitted at both the windows, a current of air would run from all parts of the chamber towards A, and therefore would have a tendency to occasion smoke: but if as much or more air came in at the windows than could get out at the door, there could be no such current; but, on the contrary, it would be forced up the chimney, and carry the smoke along with it: wherefore in this situation, a room might sometimes be cured of smoke, by making the door as close as possible; nothing could be more hurtful in this case than boring a hole in the door. But if the house was in such a situation as to be more frequently exposed to a wind which came in the direction AD, it would run little risk of being troubled with smoke.

Suppose a room, fig. 10. having a door at A, and two windows B and C, with a fire-place D. If the wind came in the direction CB or BC, and both the windows were open, it is evident that the smoke would be drawn from the chimney by the strong current of air passing through the room; or if the window upon which the wind came were closed, and the opposite one open, nearly the same effect would be produced: but if the window upon which the wind blew were open, and the opposite one and the door shut, the room would be immediately cleared of smoke entirely. In this situation, it is evident, that if the windows were badly made, so as to admit much air, it would tend to occasion smoke, especially if the door were in the same situation; it is therefore of consequence to attend to this circumstance in a situation similar to this.

Having premised so much with regard to single rooms, we shall now proceed to consider a more compound structure. Thus, let fig. 11. represent a building consisting of two chambers, K L, joined by a passage. The chamber K having a door B communicating with the passage, a window

F, and fire-place G; and that at L having a door C, another door or window D, the window E, and fire-place H, the entry to the whole being by the door A. Let us now consider what would be the effect of the wind coming from different directions upon this building. And first, suppose the wind blew in the direction AM: If all the doors and windows were close shut, and very little air were admitted, there would be little risk of smoke; but as there would surely be some admitted through these different openings, there would be some chance that the chamber L would be troubled with smoke, because of some the air which forced its passage through the chinks of the door A would pass through the doors C and D, which might produce smoke in a small degree. There would be little chance that the chamber K would smoke in this case; because although there is a general suction through the passage from B to D, yet as it is in some measure interrupted by the close door at C, it will be but small; and as the wind is interrupted in its course by the wall of the passage, some of it will be forced through the chinks of the window F, which would more than counterbalance the effects of the other suction. But if the door D were open, both the chimneys would smoke; especially if the doors B and C were open also, as the current would be then very strong towards that point. But in all cases the smoke of this house would be prevented by keeping the door at D shut, and that at A open; but if the house was in such a situation as to be more exposed to that wind than any other, it would be better to close up the door D altogether. If the wind more commonly came from M towards A, it is more than probable that a house situated like this would be quite free of smoke, as the general current of air would be towards the chimneys; but the chamber K would run greater risk than L, as the suction might sometimes be drawn towards the window F; but if the door A were in the opposite side of the passage, that inconvenience would be avoided also. If the more general current of air were from K towards L, this house behaved to be troubled with smoke unless the windows were very close: but there would not be the smallest chance for that, when it came from L towards K.

We might now proceed to give more examples of this sort: but as it would be impossible to enumerate all the variety of cases that might occur, it is imagined that these will be sufficient to give the reader an idea of the manner in which any building ought to be examined in this respect; and he must be left to his own discretion to apply the principles above explained to all the variety of cases that may occur. In large complicated buildings, it no doubt requires a greater extent of thought to combine all the various circumstances together, and draw a general conclusion, than in smaller and more simple ones; but if the following general rules are attended to, the complaints arising from this cause would be but few. 1st, Avoid as much as may be long passages leading to very distant parts of a building, as there is often a strong current of air in these which helps to disturb the free circulation of air up the chimneys. 2d, Place the chimneys in general in that side of the apartment *towards* which the wind which in general prevails most in the situation where the house is placed blows: And, 3d, make as many, if not more, doors and windows (especially such as have occasion to be most frequently open) on that side of the building *from whence* the most prevalent wind does come.

III. The third general cause of smoke in houses is the

wrong position of the house with regard to external objects, which, by interrupting the course of the air, makes it assume various directions, and wheel about in eddies, so as to prevent it from ascending with ease from the chimney top, or beats it down into the room with violence. This is more seldom the cause of smoky houses than either of the two before mentioned; although it seems to be almost the only one attended to by the persons who pretend to cure smoky houses at present, as most of their remedies are adapted to remove the disorders arising from this cause alone. We shall briefly point out the several cases in which this can occur, that every one may be enabled to judge for himself when these cures are proper or not.

The air (as has been said) is a fluid, and wind a current of that fluid; which, when driven along the surface of the earth, flows with a smooth and equal stream, unless when opposed by some object which interrupts its course; but when it meets with any object which directly opposes its course, it is in some measure pushed back again, and made to spread on every side, till it meets with some open side, towards which it flows with great impetuosity. It is likewise a fluid of considerable gravity, and therefore presses upon the surface of the earth with great force; so that, when a current of it flows along the surface of our globe, it has a tendency to move forward and press downward at the same time: from whence it happens, that when a current of air is forced over the top of any high object, the side of which descends perpendicularly downward, the velocity of the current at first overcomes the gravity, and it flies a short way over in that direction; but the power of gravity acting upon the under surface, draws it downward, and in a short time overcomes the impetus that it had to rush forward, and occasions a sort of eddy nearly similar to what we see among water behind a stone which interrupts the violence of its currents.

To illustrate this more plainly, let AB, fig. 12. represent a part of a high building, near to which is a smaller one CD; and let the dotted line EF represent a current of air flowing with considerable force in the direction FE. It is plain that it will flow straight forward over the top of the small building; but when it meets with the large object, it will be interrupted in its course, and spread itself on every side, as represented by the dotted lines GG &c. at last it will flow towards that place through which it can escape with the greatest ease. If the opposing object be large, and has no opening through which it can issue near the ground, then it will ascend to the top of it, and flow off in that direction, carrying the smoke which ascends from the small chimney C along with it: but if there is any opening below, either a street or lane, or any other passage that will admit the wind to pass, then will the natural gravity of the air draw the general current downward to flow off through the lower passage; in which case, the smoke which ought to ascend through the chimney C, meeting with a current of air opposing its passage, will not be at liberty to issue forth, but be forced back again into the room from whence it proceed, unless some contrivance is fallen upon to prevent it.

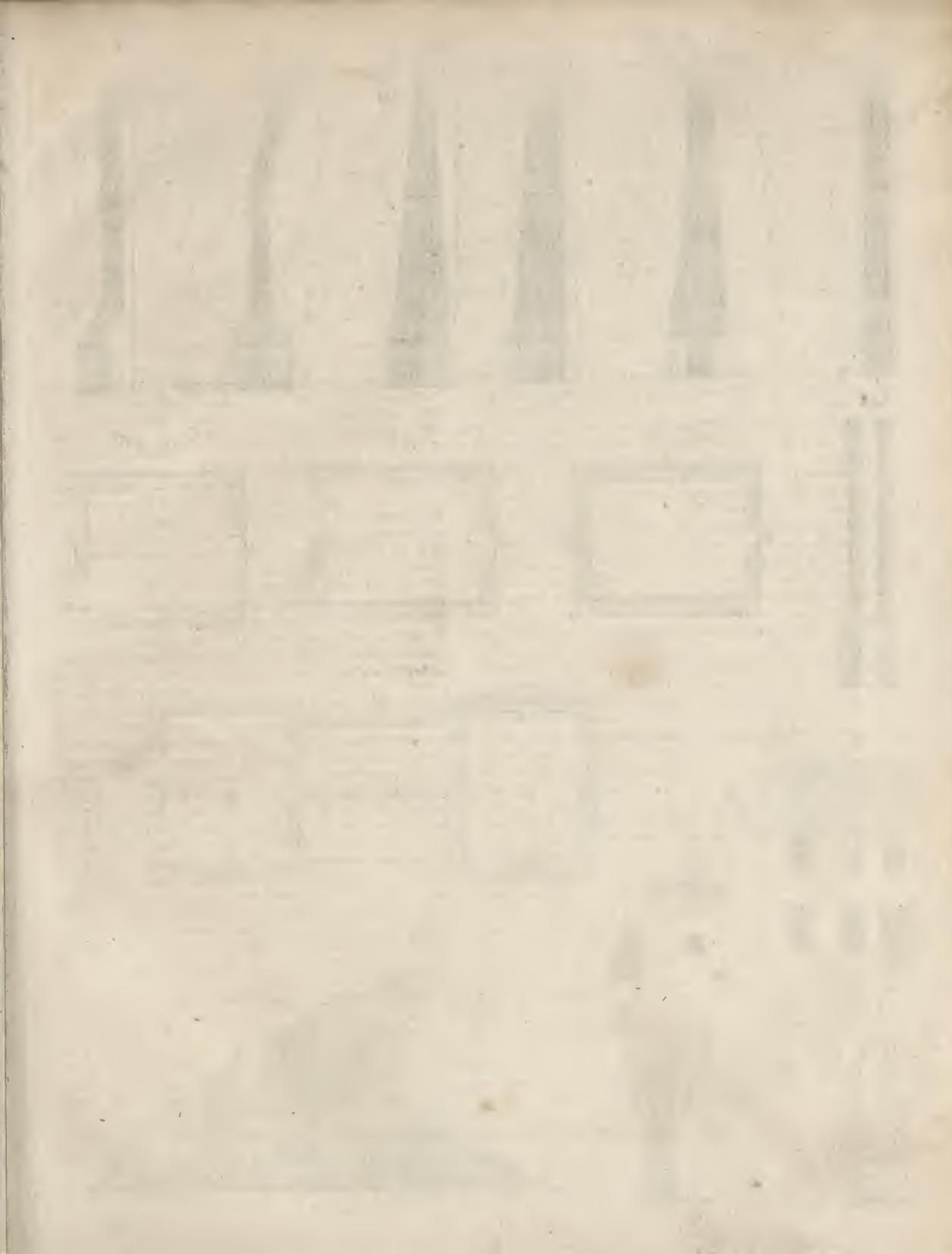
Again, let A, fig. 13. represent a small building at the side of a great rock B, and the wind coming in the direction CD; when the current of air comes to the point D, being hurried forward with great velocity, it goes a little forward, but soon descends downward, and gradually is reflected more

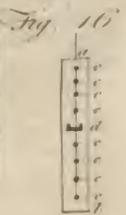
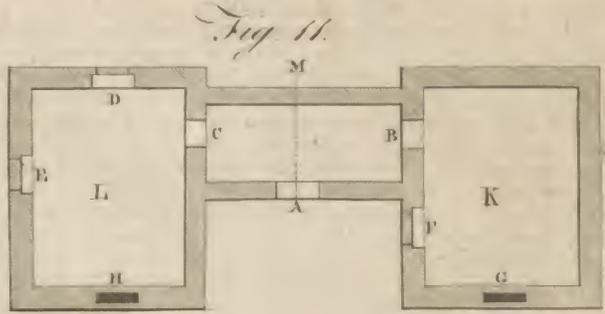
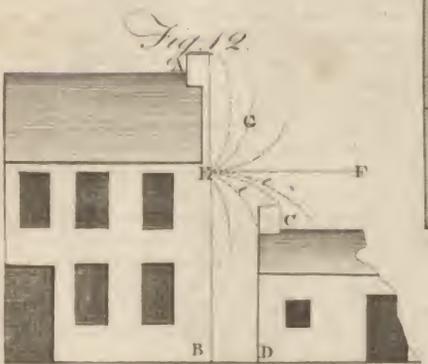
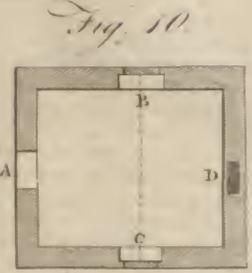
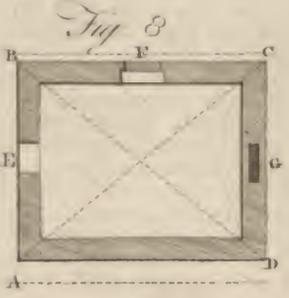
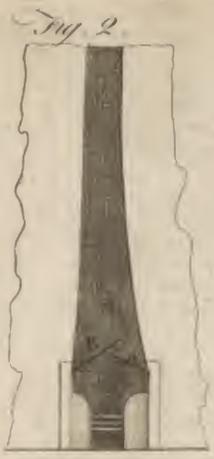
and more inward, as represented by the dotted lines E E, &c. so that, descending downwards upon the top of the chimney A, the smoke is beat again into the apartments. Thus it is that low houses, when contiguous to high objects, are in danger of being disturbed with smoke. If the contiguous object be not very high, the disorder may be cured by heightening the chimney of the low house; but if it is very high, it will be necessary to cover the top of the chimney in such a manner as to prevent the wind from entering it, at the same time that a passage is left at some of the sides through which the smoke may issue with freedom. Many are the contrivances which have been invented for this purpose, which are to be met with every where; and as there is no difficulty in accomplishing the desired end by an infinite variety of methods, every one who needs such a thing may please his own fancy in the choice. We have thought it unnecessary to add any more but one kind of these, fig. 14. which will answer the end effectually.

It is evident that houses situated near high hills, or thick woods, will be in some measure exposed to the same inconvenience; but it is likewise plain, that if a house be situated upon the slope of a hill, as at F, fig. 13. it will not be in any danger of smoke when the wind blows towards that side of the hill upon which it is situated; for the current of air coming over the house-top in the direction G H, is immediately changed by the slope of the hill to the direction H C, which powerfully draws the smoke upward from the top of the chimney. But it is also evident, that a house in this situation will be liable to smoke when the wind blows from the hill; for the current of air coming downward in the direction C H, will beat downward on the chimney F, and prevent the smoke from ascending with freedom. But the effect will be much heightened, if the doors and windows are chiefly in the lowermost side of the house.

These are some of the most general circumstances which prevent the free ascent of smoke, arising from external objects: but there are many other lesser causes which may at times occasion smoke, all of which it would be tedious here to enumerate; such as, blasts of air, reflected from the sides of mountains, and coming down valleys with great impetuosity, occasioning, in particular situations, eddies or whirlwinds of different sorts. In short, whatever in any measure disturbs the free motion of the air, is in danger of producing sudden gusts, which may occasion smoke. Therefore, whoever builds in a situation which is not altogether free, may lay his account with having some sudden gusts of smoke, unless he forms the top of his chimney so as to obviate it. And there are some situations so much exposed to sudden gusts of wind, sometimes whirling round, sometimes beat suddenly downward, or as suddenly carried up again, that it is difficult to guard against every danger. In these situations we would recommend something of the form of what is represented at fig. 15. which would be proof against every wind whatever.

Having thus traced the causes of smoky houses, and reduced them to distinct classes for the sake of distinctness; it is necessary, before we quit this subject, to observe, that in many cases, two or more of these may be combined to augment the malady, and therefore it is necessary to have all these circumstances in view in every particular case. It now only remains that we point out the several phenomena which may lead us to distinguish from which of these general causes the disorder complained of may proceed. And,





1st, If it is owing to a fault in the construction of the chimney itself, it will smoke almost continually especially in calm weather.

2d, If it does not smoke in calm weather, or only when the wind comes from some particular quarter, and can then be cured by opening some door or window, the fault may be looked for in the distribution of the doors or windows of the house. The only case in which there is a difficulty to distinguish whether it is owing to the fault of the chimney or the house, is when it proceeds from too much closeness of the apartment. But this may be easily known by trying it in a calm: for if it proceeds from this cause, there will be no smoke in a perfect calm, if the doors are left open; whereas, if the defect proceeds from a fault in the chimney itself, it will still continue to smoke when calm, even when the doors are open.

3d, When the smoke is occasioned by external causes, these can be generally seen; but it may be likewise known by this, that it descends in sudden puffs with great violence at times, even when the doors and windows are not altered. By attending to these few rules with care, there will be little danger of mistaking the cause from whence this disorder proceeds.

We shall conclude these observations with a few remarks on some particular cases which can hardly be reduced to any of the foregoing heads. And,

1st, It sometimes happens, that the smoke is prevented from ascending with freedom, by having a small part of the top of the chimney broke down, so as that some parts of it remain higher than others, which in some measure reduces it to the state of a chimney at the side of a higher one. To prevent this, it is always proper to have the top of the chimney finished with stones neatly cut, and firmly built. It is not to be doubted but that those things which are placed upon particular chimneys with a view to cure them of smoke, do often, from the same cause, hurt the neighbouring chimneys built in the same wall.

2d, A chamber is sometimes filled with smoke, when a fire is kindled in a neighbouring chimney, and none in it, although there is no appearance of smoke when it has a fire burning in its own grate. This may sometimes proceed from a small hole breaking through the thin partition that divides the two chimneys from one another, and as smoke is a weighty body, which is only buoyed up by the warm air which passes through the fire, when it penetrates into the cold chimney it naturally subsides, and comes down to the chamber with which the chimney communicates, when there is no fire to carry it off. But this disease is generally produced by the smoke entering at the top of the chimney, and descending downwards: if this last is the case, it may be cured, on many occasions, by setting a pretty high stone at the top of the chimney, as a division between each two: but the surest method, in all cases, is to have a smoke-board exactly fitted into the chimney above the grate, which on all occasions effectually prevents it.

3d, It frequently happens, that a chimney does not carry off the smoke well at first when the fire is kindled, although there is not the smallest tendency to it at other times. This proceeds from the narrowness of the chimney; for when the fire is kindled, the whole tube is filled with cold air, as weighty as that in the apartment; and being expanded by the fire at the bottom; it endeavours to ascend upward, but being pent in by the narrowness of the tube, and pressed by

the column of cold air above it, it is some time before it can wholly overcome that resistance, and some of it is forced into the chamber, till by degrees the whole chimney is heated, and then it vents quite well. If the smoke produced by this means is not very troublesome, it may be borne with; but if it be extremely disagreeable, it may be cured by having a large sheet of milled iron, large enough to reach between the two sides of the fire-place, and as deep as to reach from the mantle to the grate, or lower, which might by any contrivance be hung up before the fire at that time to act in some measure as a *smoke-chimney*. This would quickly make the fire burn, and carry off the smoke entirely. After that is effected, it might then be removed, till another occasion.

SMOLENSKO, the capital of a province of the same name in Muscovy, situated on the confines of Poland: in E. long. 32°, and N. lat. 56°.

SMUGGLERS, in law, those persons who conceal or run prohibited goods, or goods that have not paid his Majesty's customs.

SMUT, in husbandry, a disease in corn, when the grains, instead of being filled with flour, are full of a stinking black powder.

There are two remedies for the smut, recommended by writers on husbandry; *viz.* steeping the seed in salt brine, and changing the seed.

As to the steeping of seed, when wheat is intended for drilling, it must be soaked in a brine of pure salt, dissolved in water, since urine is found to be highly prejudicial. The most expeditious way of brining wheat for drilling, is to lay it in a heap, and wash it with a strong brine sprinkled on it, stirring it up with a shovel, that it may be all equally brined, or wetted with it; after this, sift on some fine lime all over the surface, and stir it up, still sifting on more in the same manner till the whole is dusted with the lime: it will then be soon dry enough to be drilled without farther trouble. It must be quick-lime, in its full strength, that is used on this occasion.

The bread made of smutty corn, is very pernicious, acting as a narcotic, and occasioning not only sleepiness, but vertigos, and even convulsions.

SMYRNA, a city and port-town of Asiatic Turkey, situated on a bay of the Archipelago, in the province of Ionia, in Lesser Asia, 100 miles north of Rhodes, and 200 miles nearly south of Constantinople: E. long. 27°, N. lat. 37° 30'.

SMYRNIUM, in botany, a genus of the pentandria digynia class. The fruit is oblong, and striated; and the petals are sharp-pointed, and carinated. There are five species, only one of them, *viz.* the olusatrum, or alexanders, a native of Britain.

SNAFFLE, in the manege, is a very slender bit-mouth, without any branches, much used in England; the true bridles being reserved for the service of war.

SNAIL, in zoology. See LIMAX.

SNAKE, in zoology. See ANGUIS.

SNAKE ROOT, in botany. See POLYGALA.

SNAKE WEED, in botany. See POLYGONUM.

SNAPDRAGON, in botany. See ANTIRRHINUM.

SNEEZING, a convulsive motion of the muscles of the throat, whereby the air is expelled from the nose with much vehemence and noise.

Sneezing is caused by the irritation of the upper membrane.

brane of the nose, occasioned by acrid substances floating in the air, or by medicines called sennatories.

**SNETHAM**, a market-town of Norfolk, twenty-eight miles north-west of Norwich.

**SNIPE**, in ornithology. See **TANTALUS**.

**SNOW**, a meteor produced in this manner: When the vapours are become considerably condensed, yet not so far as to be liquified, or dissolved into water; then, by a special degree of coldness in the upper region of the air, the particles of the condensed vapour are changed into ice; several of which adhering together, form little fleeces of a white substance, somewhat heavier than the air; and therefore descend in a slow and gentle manner through it; being subject, by reason of its lightness, to be driven about by the various motions of the air and wind; and is what, when arrived to the surface of the earth, we call snow.

Snow fructifies the ground; for instance, by guarding the corn or other vegetables from the intenser cold of the air, especially the cold piercing winds.

**SNOWDON-HILL**, the highest mountain in Wales, situated in Caernarvonshire.

**SNOW-DROP**, in botany. See **GALANTHUS**.

**SNUFF**, a powder chiefly made of tobacco, the use of which is too well known to need any description here.

**SOAL-FISH**, in ichthyology. See **PLEURONECTES**.

**SOAP**, a kind of paste, sometimes hard and dry, and sometimes soft and liquid, much used in washing, whitening linens, and by dyers, fullers, &c. See **CHEMISTRY**, p. 93, 149, 154.

The purer hard soap is the only sort intended for internal use. This, triturated with oily or resinous matters, renders them soluble in water; and hence becomes an ingredient in pills composed of resins, promoting their dissolution in the stomach, and union with the animal fluids. Boerhaave always prescribed soap in resinous pills, unless where an alkalescent or putrid state of the juices forbid its use. From the same quality, soap seems well fitted for dissolving oily or unctuous matters and viscidities in the human body; thereby opening obstructions, and detaching all the vessels it passes through. It is likewise a powerful menstruum for the calculus, or stone in the bladder; a solution of it in lime-water being one of the strongest dissolvents that can with safety be taken into the stomach: the virtue of this composition is considerably greater than the aggregate of the dissolving powers of the soap and lime-water when unmixed.

**SOCAGE**, an ancient tenure, by which lands were held on condition of ploughing the lord's lands, and doing the operations of husbandry, at their own charges.

**S OCCUS**, in antiquity, a kind of high-shoe, reaching above the ankle, worn by comedians, as the cothurnus was by tragedians.

**SOCIETY**, in general, denotes a number of persons united together for their mutual assistance, security, interest, or entertainment.

The social principle in man is of such an expansive nature, that it cannot be confined within the circuit of a family, of friends, of a neighbourhood: it spreads into wider systems, and draws men into larger communities and commonwealths; since it is in these only, that the more sublime powers of our nature attain the highest improvement and perfection of which they are capable.

**Royal Society**, an academy or college, established by charter, by king Charles II. for promoting natural knowledge, and useful arts, by experiments.

It consists of several hundred fellows, or members, mostly British; some persons of the highest rank, and many eminent gentlemen and learned men of other nations. Their meetings are held once a week, at their house in Crane-Court, Fleet-Street, London; where they discourse upon the productions and rarities of nature and art, and consider how the same may be improved for the good of mankind: here are also read letters, and other philosophical papers, sent by ingenious persons both at home and abroad; upon which they discourse in the plainest manner, without affecting studied speeches.

This society, of which his Britannic majesty is perpetual patron, is governed by a council of twenty-one members; ten of whom are yearly chosen out of the society, on St. Andrew's-day. The chief of the council bears the title of president, whose proper office is, to call and dissolve the meetings; to propose the matter to be debated; call for experiments; and admit such members as shall be elected, which must be by a majority of at least twenty-one votes; whereupon he is admitted, after paying 40 s. and subscribing that he will endeavour to promote the good of the Royal Society of London by the improvement of natural knowledge; and being thus admitted, he afterwards pays 13 s. a quarter, as long as he continues a member of the society.

**SOCIETY for the encouragement of arts, manufactures, and commerce.** The public spirit of this age is no-where more remarkably shewn, than in the flourishing condition of this valuable society, whose object is the improvement of the polite, useful, and commercial arts, in all their various branches, by exciting industry and emulation among all who can be stimulated by honorary or pecuniary rewards. It was set on foot in the year 1753, by the Lord Falkstone, Lord Romney, Dr Hales, and seven or eight private gentlemen, who were brought together by the unwearied pains of Mr William Shipley, who had long laboured to reduce into practice a scheme he had formed for this purpose. This society, at their second meeting, determined to make a beginning, by proposing rewards for the discovery of cobalt, for the encouragement of boys and girls in the art of drawing, and for the planting of madder in this kingdom. And now money being wanted, a voluntary subscription was begun; soon after which a plan was drawn up for forming, regulating, and governing the society: and now the utility of such a society became so well understood, that immediately several noblemen and gentlemen offered themselves as members; and ever since that time, its increase has been so extraordinary, that it consists of several thousand members, among whom are most of the nobility, and persons of large fortunes in the kingdom. The officers of this society are, a president, eight vice-presidents, a register, a secretary, and an assistant-secretary, who are all chosen by ballot annually on the first Tuesday in March. Every person desiring to be a member of this society must be proposed by three members: his name, addition, and place of abode, being read aloud by the secretary, he is ballotted for at the next meeting: he shall be deemed a perpetual member upon payment of twenty guineas, or a subscribing member upon payment of any sum not less than

than two guineas annually. Ladies are also admitted members, and foreigners are likewise admitted as honorary or corresponding members. The money of the society is placed in the bank of England, in the name of the president and vice-presidents, three of whom are empowered to draw any sum the society shall order, to be paid. The society's office is opposite to Beauford buildings in the Strand, in London, where their meetings are held every Wednesday evening, from the second Wednesday in November, to the last Wednesday in May, and at other times every first and third Wednesday of every month.

**SOCIETY** for the reformation of manners, and putting in execution the laws against immorality and profaneness. It was set on foot about forty years ago, by five or six private persons in London, but is since exceedingly increased by numbers of all denominations. A particular body of the most considerable hereof, bear the expence of prosecutions, &c. without any contribution from the rest. These chiefly apply themselves to the prosecuting people for swearing, drunkenness, and prophaning the sabbath. Another body, of about fifty persons, apply themselves to the suppressing lewdness, and by them above five hundred lewd houses have been actually suppressed; a third body consists of constables; and a fourth of informers. Besides these, there are eight other regular mixed bodies of house-keepers and officers, who inspect the behaviour of the constables and other officers, assist in searching disorderly houses, seizing offenders, giving information, &c. There are several other societies of this kind at Bristol, Canterbury, Nottingham, &c.

**SOCIETY** for propagating the gospel in foreign parts, was instituted by king William, in 1701, for securing a maintenance for an orthodox clergy, and making other provisions for the propagation of the gospel in the plantations, colonies, frontiers, &c. To that end he incorporated the archbishops, several bishops, and other nobility, gentry, and clergy, to the number of ninety, with privilege to purchase two thousand pounds per year, inheritance and estates for lives or years, with other goods to any value. They meet yearly on the third Friday of February, to chuse a president, vice-president, and other officers; and the third Friday in every month to transact business, depute fit persons to take subscriptions for the said uses, and of all moneys so received to give account to the lord chancellor, &c. They have a standing committee at the chapter-house to prepare matters for the monthly meeting which is held at St. Martin's library.

**SOCIETY** for propagating Christian knowledge. This was begun in 1699 by some persons of worth, &c. Its original design was to propagate religion in the plantations, to secure the pious education of the poor at home, and to reclaim those that err in the fundamentals of Christianity. In the year 1701, they had procured considerable charities, and transmitted the same to the plantations, in libraries, bibles, catechisms, &c. with a voluntary maintenance for several ministers to be employed in the plantations; but the society for propagating the gospel in foreign parts being then instituted, they were incorporated by charter in the same, and thus discharged as a particular society from the further pursuit of that branch of their original design; whereupon they wholly turned themselves to the other, and are now very considerable by great accessions

from the clergy and laity. They meet weekly to concert measures for raising charity for educating poor children, and setting up schools for that purpose, as also for the more regular disposal of books for the instruction of the ignorant, erroneous, &c.

For the other societies established by charter, see COLLEGE, COMPANY, CORPORATION, and STOCKS. SOCIETY, in Scots law. See LAW, Tit. xxii. 5. SOCII CRIMINIS, in Scots law. See LAW, Tit. xxxiii. 50.

**SOCINIANS**, in church-history, a sect of Christian heretics, so called from their founder Faustus Socinus, a native of Sienna in Italy. He, about the year 1574, began openly to declare against the catholic faith, and taught, 1. That the eternal Father was the one only God; that the Word was no more than an expression of the Godhead, and had not existed from all eternity; and that Jesus Christ was God no otherwise than by his superiority above all creatures who were put in subjection to him by the the Father. 2. That Jesus Christ was not a mediator between God and men, but sent into the world to serve as a pattern of their conduct. 3. That the punishment of hell will last but for a certain time, after which the body and soul will be destroyed. And, 4. That it is not lawful for princes to make war. These four tenets were what Socinus defended with the greatest zeal. In other matters, he was a Lutheran or a Calvinist; and the truth is, that he did but refine upon the errors of all the anti-trinitarians that went before him.

**SOCOTORA**, an island in the Indian ocean, about seventy miles long, and fifty broad: situate in E. long. 55°, N. lat. 11'

**SOCRATIC PHILOSOPHY**, the doctrines and opinions, with regard to morality and religion, maintained and taught by Socrates. By the character of Socrates left us by the ancients, particularly by his scholar Plato, Laertius, &c. he appears to have been one of the best and the wisest persons in all the heathen world. To him is ascribed the first introducing of moral philosophy, which is what is meant by that usual saying, "That Socrates first called philosophy down from heaven to earth;" that is, from the contemplation of the heavens and heavenly bodies, he led men to consider themselves, their own passions, opinions, faculties, duties, actions, &c. He wrote nothing himself; yet all the Grecian sects of philosophers refer their origin to his discipline, particularly the platonists, peripatetics, academics, cyrenaics, stoics, &c. but the greatest part of his philosophy we have in the works of Plato.

**SODA**, or *HEAT of the stomach*, in medicine, the name of a distemper consisting in a heat or troublesome burning about the pit of the stomach, or its left mouth which sometimes is extended the whole length of the œsophagus, with a pressure or spasmodic constriction, usually attacking the patient by fits. See MEDICINE.

**SODBURY**, a market-town of Gloucestershire, situated ten miles north-east of Bristol.

**SODOMY**, the unnatural crime of buggery, thus called from the city of Sodom, which was destroyed by fire for the same. The Levitical law adjudged those guilty of this execrable crime to death, and the civil law assigns the same punishment to it. Our law also makes it felony.

There is no statute in Scotland against sodomy; the

libel of the crime is therefore founded on the divine law, and practice makes its punishment to be burning alive.

**SOFA**, in the Turkish customs, a bench of wood raised from the ground about a foot high, and placed round a hall or chamber for the people to sit down upon, or to lie along, and in that posture to take a view of what passes in the streets, &c. for these benches are surrounded with windows; they are covered with fine Turkey carpets; and upon that are placed cushions of sattin, flowered with gold or some other rich stuff.

**SOFALA**, the capital of the territory of that name in Africa, situated at the mouth of the river Sofala, in E. long. 35°, S. lat. 20°.

**SOFFITA**, or **SOFFIT**, in architecture, any plafond or ceiling formed of cross beams of flying corniches, the square compartments or pannels of which are enriched with sculpture, painting or gilding; such are those in the palaces of Italy, and in the apartments of Luxemburg at Paris.

**SOFTENING**, in painting, the mixing and diluting of colours with the brush or pencil.

**SOGDIANA**, a country of Asia, situated on the north side of the river Oxus, which separated it from the ancient Bactria, now a part of Usbec Tartary.

**SOHAM**, a market-town of Cambridgeshire, situated on a lake called Soham Meer, in the isle of Ely, fourteen miles north-east of Cambridge.

**SOIL**, in agriculture. See **AGRICULTURE**, p. 50.

**SOISSONS**, a city of France, in the province of the isle of France, situated on the river Aysse, fifty-five miles north-east of Paris.

**SOL**, the Sun, in astronomy, &c. See **ASTRONOMY**, p. 435.

**SOL**, in chemistry, is gold. See **CHEMISTRY**, p. 78.

**SOL**, in heraldry, denotes Or, the golden colour in the arms of sovereign princes.

**SOLÆUS**, in anatomy. See **ANATOMY**, p. 209.

**SOLANUM**, in botany, a genus of the pentandria monogynia class. The corolla is rotated; the antheræ are very close together, opening with a double pore at the points; and the berry has two cells. There are 30 species, two of them natives of Britain, *viz.* the nigrum, or common nightshade; and the dulcamara, or woody nightshade.

Common nightshade is used to allay inflammations.

Some years ago, the internal use of the solanum was much recommended by some writers, in cancerous cases, foul ulcers, and scorbutic eruptions: however, later experience has found this simple to be not only of little or no efficacy in such cases, but to be attended with actual danger to the patient.

**SOLAR**, something belonging to the sun. See **ASTRONOMY**, p. 435.

**SOLDANELLA**, in botany, a genus of the pentandria monogynia class. The corolla is bell-shaped, and split into many segments. There is but one species, a native of Switzerland.

**SOLDER**, a metallic or mineral composition used in soldering or joining together other metals.

Solders are made of gold, silver, copper, tin, bismuth, and lead; usually observing, that in the composition there be some of the metal that is to be soldered mixed with some higher and finer metals. Goldsmiths usually make four kinds of folder, *viz.* folder of eight, where to

seven parts of silver there is one of brass or copper; folder of six, where only a sixth part is copper; folder of four, and folder of three. It is the mixture of copper in the folder that makes raised plate come always cheaper than flat. The folder used by plumbers is made of two pounds of lead to one of block-tin. Its goodness is tried by melting it, and pouring the bignets of a crown-piece upon a table; for if good, there will arise little bright shining stars therein. The folder for copper is made like that of the plumbers, only with copper and tin; for very nice works, instead of tin they sometimes use a quantity of silver. Solder for tin is made of two thirds of tin and one of lead, but where the work is any thing delicate, as in organ pipes, where the juncture is scarce discernable, it is made of one part of bismuth and three parts of pewter.

**SOLDERING**, among mechanics, the joining and fastening together two pieces of the same metal, or of two different metals, by the fusion and application of some metallic composition on the extremities of the metals to be joined. See the last article.

To folder upon silver, brass, or iron: take silver, five penny-weight; brass, four penny-weight; melt them together for soft folder, which runs soonest. Take silver, five penny-weight; copper, three penny-weight; melt them together for hard folder. Beat the folder thin, and lay it on the place to be foldered, which must be first fitted and bound together with wire, as occasion requires; then take borax in powder, and temper it like pap, and lay it upon the folder, letting it dry; then cover it with quick coals, and blow, and it will run immediately; take it presently out of the fire, and it is done. It is to be observed, that if any thing is to be foldered in two places, which cannot well be done at one time, you must first folder with the harder folder, and then with the soft; for if it be first done with the soft, it will unfold again before the other is foldered. Let it be observed, that if you would have the folder run about the piece that is to be foldered, you must rub such places over with chalk.

In the foldering either of gold, silver, copper, and all the metals before-mentioned, there is generally used borax in powder, and sometimes rosin. As to iron, it is sufficient that it be heated red hot, and the two extremities thus hammered together, by which means they will become incorporated into one another.

**SOLDIER**, a military man fitted to serve a prince or state, in consideration of a certain daily pay.

**SOLE**, in the manege, a nail or sort of horn under a horse's foot, which is much more tender than the other horn that incompasses the foot, and by reason of its hardness is properly called the horn or hoof.

**SOLEA**, in ichthyology. See **PLEURONECTES**.

**SOLEÆ**, among the Romans, a kind of sandals or slippers, which covered only the sole of the feet, and were bound on with thongs of leather, instead of which the women and the effeminate ones of the other sex tied them on with purple-coloured ribbons, or such as were variously adorned with gold and silver.

**SOLECISM**, in grammar, a false manner of speaking contrary to the use of language and the rules of grammar, either in respect of declension, conjugation, or syntax.

**SOLEMNITIES OF DEEDS**, in Scots law. See **WRITINGS**.

**SOLEN**, in zoology, a genus of insects belonging to the order

- order of vermes testacea. The shell is oblong, bivalved, and opening at both sides; the cardo has a subulated reflected tooth, not inserted into the opposite valve. There are eleven species, distinguished by peculiarities in their shells.
- SOLFAING**, in musick, the naming or pronouncing the several notes of a song by the syllables *ut, re, mi, fa, sol, &c.* and in learning to sing it. See **MUSICK**.
- SOLICITOR**, a person employed to take care of, and manage suits depending in the courts of law or equity.
- There is also a great officer of the law, next to the attorney-general, who is styled the king's solicitor-general; who holds his office by patent, during the king's pleasure has the care and concern of managing the king's affairs, and has fees for pleading, besides other fees arising by patents, &c. He hath his attendance on the privy-council; and the attorney-general and he were anciently reckoned among the officers of the exchequer; they have their audience, and come within the bar in all other courts.
- SOLID**, a body whose parts are so firmly connected together, as not to give way, or slip from each other upon the smallest impression, in which sense, solid stands opposed to fluid.
- SOLIDAGO**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is naked; the pappus is simple; the calix is imbricated with shut scales. There are twelve species, two of them natives of Britain. *viz.* the virgaurea, or common golden rod; and the cambrica, or Welch golden rod.
- SOLIDITY**, that property of matter, or body, by which it excludes all other bodies from that place which itself possesses. See **METAPHYSICS**.
- SOLILOQUY**, a reasoning or discourse which a man holds with himself; or, more properly, according to Papias, it is a discourse by way of answer to a question that a man proposes to himself.
- Soliloquies are become very common things on the modern stage; yet can nothing be more unnatural, than an actor's making long speeches to himself, to convey his intentions to the audience. Where such discoveries are necessary to be made, the poet should rather take care to give the dramatic persons such confidants as may necessarily share their inmost thoughts, by which means they will be more naturally conveyed to the audience: yet is even this a shift an accurate poet would not be found to have occasion for.
- SOLITARY**, something retired or in private, remote from the company or commerce of others of the same species.
- SOLITARIES**, a denomination of nuns of St. Peter of Alcantara, instituted in 1576, the design of which is to imitate the severe penitent life of that saint: thus they are to keep a continual silence, never to open their mouths to any body but themselves; employ their time wholly in spiritual exercises, and leave the temporal concerns to a number of maids, who have a particular superior in a separate part of the monastery. They always go bare footed, without sandals, gird themselves with a thick cord, and wear no linen.
- SOLMS**, the capital of the county of Solms, in the landgraviate of Hesse-Cassel, in Germany, thirty-five miles north of Frankfort.
- SOLO**, in musick, a term used in pieces consisting of several parts, to mark those that are to perform alone.
- SOLOMON'S ISLANDS**, a cluster of islands in the Pacific ocean, situated between 130° and 140° W. long. and between 7° and 12° S. lat.
- SOLOMON'S SEAL**, in botany. See **CONVALLARIA**.
- SOLOTHURN**, one of the cantons of Switzerland, lying between those of Basil and Bern, the former on the north, and the latter on the south.
- The city of Solothurn, capital of the said canton, is situated in E. long. 7° 15', and N. lat. 47° 18'.
- SOLSTICE**, in astronomy, that time when the sun is in one of the solstitial points; that is, when he is at his greatest distance from the equator. See **ASTRONOMY**.
- SOLVENT**, the same with dissolvent. See **DISSOLVENT**.
- SOLUTION**, in chemistry, denotes an intimate mixture of solid bodies with fluids, so as seemingly to form one homogeneous liquor; the dissolving fluid is termed the dissolvent or menstruum. See **CHEMISTRY**, *passim*.
- SOMERSETSHIRE**, a county of England, situated on the Bristol channel, and bounded by Wiltshire on the east, by Dorsetshire on the south, and by Devonshire on the west: it is famous for the cloth manufacture.
- SOMERTON**, a market-town of Somersetshire, twelve miles south of Wales.
- SOMME**, a river of France, which running from east to west through Picardy, by Amiens and Abbeville, falls into the British channel near St. Vallery.
- SOMNAMBULI**, in medicine, persons who walk in their sleep, otherwise called noctambuli.
- SON**, an appellation given to a male child, considered in the relation he bears to his parents.
- SONATA**, in musick, a piece, or composition, intended to be performed by instruments only; in which sense, it stands opposed to cantata, or a piece designed for the voice.
- SONCHUS**, the sow-thistle, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; the calix is imbricated, and ventricose; and the pappus is plumose. There are ten species, three of them natives of Britain. *viz.* the oleraceus, or common sow-thistle; the arvensis, or tree sow-thistle; and the palustris, or marsh sow-thistle.
- Sonchus is accounted cooling and attenuant, and accordingly prescribed in the stranguries, as also in inflammations of all kinds, to be applied externally in the form of a cataplasm.
- SONG**, in poetry, a little composition, consisting of easy and natural verses, set to a tune in order to be sung.
- SONG**, in musick, is applied in general to a single piece of musick, whether composed for the voice or an instrument.
- SONNA**, a book of Mahometan traditions, wherein all the orthodox muslims are required to believe.
- SONNET**, in poetry, a composition contained in fourteen verses, *viz.* two stanzas, or measures, of four verses each; and two of three; the eight first verses being all in three rhimes.
- SONNETTES**, among the Mahometans, an appellation given to the orthodox muslims, or true believers; in opposition to the several heretical sects, particularly the schites, or followers of Ali.
- SOOT**, a volatile matter, arising from wood, and other fuel along with the smoke; or rather, it is the smoke itself condensed and gathered on the sides of the chimney. See **CHEMISTRY**, p. 158. and **AGRICULTURE**, p. 49.

**SOPHIA**, a title given to the emperor of Persia; importing as much as wife, sage, or philosopher. There is no prince in the world whose authority is more absolute than that of the sophi of Persia.

**SOPHISM**, in logic, &c. an argument which carries much of the appearance of truth, and yet leads into error.

**SOPHIST**, a person who uses sophisms, with a view to deceive those he would persuade or convince.

**SOPHISTICATIO**N, the adulterating any thing with what is not good or genuine; a practice too common in the making up medicines for sale; as also among vintners, distillers, and others, who are accused of sophisticating their wines, spirits, oils, &c. by mixing with them cheaper and coarser materials: and, in many cases, the cheat is carried on so artfully as to deceive the best judges.

**SOPHORA**, in botany, a genus of the decandria monogynia class. The calix has five teeth, and is gibbous above; the corolla is papilionaceous, with the wings of the same length as the vexillum; and the capsule is a legumen. There are eight species, none of them natives of Britain.

**SOPORIFIC MEDICINES**, are those capable of procuring sleep, as opiates, &c. See **OPIATES**, &c.

**SORBONNE**, the house or college of the faculty of theology, in the university of Paris; sometimes also used for the faculty itself, because it usually assembles in the house of the sorbonne.

**SORBUS**, in botany, a genus of the icofandria trigynia class. The calix consists of five leaves, and the corolla of five petals; and the berry contains three seeds. There are three species, two of them natives of Britain, *viz.* the domestica, or the true service or sorb; and the aucuparia, quicken-tree, or mountain-ash.

**SORCERY**, the crime of witchcraft or divination by the assistance of an evil spirit. See **WITCHCRAFT**.

**SORET**; a province of the Hither India, lying northwards of Guzerat: its chief town is Jaganat.

**SOREX**, in zoology. See **MUS**.

**SORITES**, in logic, a species of reasoning, in which a great number of propositions are so linked together, that the predicate of the one becomes continually the subject of the next following, till at last a conclusion is formed by bringing together the subject of the first proposition and the predicate of the last. See **LOGIC**.

**SORNERS**, in Scots law. See **LAW**, Tit. xxxiii. 30.

**SORREL**, in botany. See **RUMEX**.

*Wood Sorrel*, in botany. See **OXALIS**.

**SORREL COLOUR**, in the menage, is a reddish colour, generally thought to be a sign of a good horse.

**SORRENTO**, a city and port-town of the kingdom of Naples, eighteen miles south of that city.

**SORTILEGE**, a species of divination, performed by means of sortes or lots.

The sortes prenestinæ, famous in antiquity, consisted in putting a number of letters, or even whole words, into an urn; and then, after shaking them together, they were thrown on the ground, and whatever sentences could be made out from them constituted the answer of the oracle.

Another kind of sortes consisted in taking some celebrated poet, as Homer or Virgil; and, opening the book, whatever presented itself first to the eye made the answer; and hence it got the name of sortes homericæ, and sortes virgilianæ, &c.

The superstitious among the ancient Christians practised a similar kind of divination, by opening the Old and New Testament; whence it got the name of sortes sanctorum.

**SOTERIA**, in antiquity, sacrifices offered to the gods for delivering a person from danger; as also poetical pieces composed for the same purpose.

**SOTOVENTO ISLANDS** are situated on the coast of Terra-Firma; the chief of which are Trinidad, Margareta, Tortuga, &c. They are also called the Lesser Antilles.

**SOUBISE**, a town of Guienne, in France, situated on the river Charente, seventeen miles south of Rochelle.

**SOUGH**, among miners, denotes a passage dug under ground, to convey off water from mines.

**SOVEREIGN**, in matters of government, is applied to the supreme magistrate, or magistrates, of an independent government or state; by reason their authority is only bounded by the laws of God, of nature, and the fundamental laws of the state: such are kings, princes, &c.

**SOUL**, a spiritual substance, which animates the bodies of living creatures: it is the principle of life and activity within them.

Various have been the opinions of philosophers concerning the substance of the human soul. The Cartesians make thinking the essence of the soul. Others again hold, that man is endowed with three kinds of souls, *viz.* the rational, which is purely spiritual, and infused by the immediate inspiration of God; the irrational, or sensitive, which is common to man and brutes; and lastly, the vegetative soul, or principle of growth and nutrition.

That the soul is an immaterial substance appears from hence, that its primary operations of willing and thinking have not only no connection with the known properties of body, but seem plainly inconsistent with some of its most essential qualities. For the mind discovers no relation between thinking and the motion and arrangement of parts.

As to the immortality of the human soul, the arguments to prove it may be reduced to the following heads: 1. The nature of the soul itself, its desires, sense of moral good and evil, gradual increase in knowledge and perfection, &c. 2. The moral attributes of God.

Under the former of these heads it is urged, that the soul, being an immaterial intelligent substance, does not depend on the body for its existence; and therefore may, nay, and must, exist after the dissolution of the body, unless annihilated by the same power which gave it a being at first. This argument, especially if the infinite capacity of the soul, its strong desire after immortality, its rational activity and advancement towards perfection, be likewise considered, will appear perfectly conclusive to men of a philosophical turn; because nature, or rather the God of nature, does nothing in vain.

But arguments drawn from the latter head, *viz.* the moral attributes of the Deity, are not only better adapted to convince men unacquainted with abstract reasoning, but equally certain and conclusive with the former: for as the justice of God can never suffer the wicked to escape unpunished, nor the good to remain always unrewarded; therefore, arguments drawn from the manifest and constant prosperity of the wicked, and the frequent unhappiness of good men in this life, must convince every thinking person, that there is a future state wherein all

will be set right, and God's attributes of wisdom, justice, and goodness, fully vindicated. We shall only add, that had the virtuous and conscientious part of mankind no hopes of a future state, they would be of all men most miserable: but as this is absolutely inconsistent with the moral character of the Deity, the certainty of such a state is clear to a demonstration.

**SOUND**, a simple perception, or idea, communicated to the soul, by means of the ear, which is the primary organ of hearing. See *ANATOMY*, p. 295. and *PNEUMATICS*, p. 488.

**SOUND**, in geography, denotes in general any strait, or inlet, of the sea, between two head-lands. However, the name sound is given, by way of eminence, to the strait between Sweden and Denmark, joining the German ocean to the Baltic, being about four miles over.

**SOUNDING**, in navigation, is the trying the depth of the water, and the quality of the bottom, either by an inch or three-quarter rope, with a deep sea-lead at the end of it. See *NAVIGATION*.

**SOUP**, a kind of pottage made of bread and broth, or the juice of flesh, or some other matters, usually served at the beginning of a meal.

**SOURIS**, in the manege, is a cartilage in the nostrils of a horse, by means of which he snorts.

**SOUTH**, one of the four cardinal points from which the winds blow. See *NAVIGATION*, and *PNEUMATICS*.

**SOUTHAM**, a market town of Warwickshire, situated seven miles south-east of Warwick.

**SOUTHAMPTON**, a borough and port town of Hampshire, situated on a bay of the English channel, twelve miles south-west of Winchester. It sends two members to parliament.

**SOUTHERN-WOOD**, in botany. See *ARTEMISIA*.

**SOUTHMOULTON**, a market-town of Devonshire, situated twenty-four miles north-west of Exeter.

**SOUTHPERTON**, a market town of Somersetshire, situated twenty-two miles south of Wells.

**SOUTHWARK**, a borough of Surry, and a suburb to London with which it has a communication by a magnificent bridge. It is situated on the south side of the Thames, and sends two members to parliament.

**SOUTHWELL**, a market-town of Nottinghamshire, situated eight miles north-east of Nottingham.

**SOUTHWOULD**, a port-town of Suffolk, situated on a bay of the German Sea, forty-two miles east of Bury.

**SOUVIGNY**, a town of France, in the province of Lyons, and territory of Bourbonnois, situated fifty miles south-east of Bourges.

**SOW**, in zoology. See *Sus*.

**Sow**, in the iron-works, the name of the block or lump of metal they work at once in the iron furnace.

**SOWING**, in agriculture. See *AGRICULTURE*, p. 59.

**SPAW**, a town of Germany, in the circle of Westphalia, and bishopric of Liege, situated seventeen miles south-east of Liege, famous for its mineral waters ever since the time of the Romans, of which there are still great quantities sent abroad to all parts of Europe.

Spaw waters are the lightest and most subtle of all the mineral waters. One very remarkable virtue of this water is, that it greatly relieves in all disorders of the kidneys, ureters, and bladder, whether occasioned by stone, gravel, or ulcerations. It possesses, beside, all the vir-

tues of the other mineral waters, and is of the greatest service in edulcorating sharp, and dividing viscid humours, and removing all diseases arising from these causes, by disposing them to pass off by proper emunctories.

**SPACE** is defined by Mr Locke to be a simple idea which we attain both by our sight and touch; the modes whereof are distance, capacity, extension, duration, &c. See *METAPHYSICS*.

**СПАЦЕ**, in geometry, denotes the area of any figure, or that which fills the interval or distance between the lines that terminate it.

**SPAGIRIC ART**, a name given by authors to that species of chemistry which works on the metals, and is employed in the search of the philosopher's stone.

**СПАНИ**; horsemen in the Ottoman army, chiefly raised in Asia. The great strength of the grand seignior's army consists in the janizaries who are the foot, and the spahis, who are the horse.

**SPAIN**, including Portugal, is a large peninsula of Europe, lying between 10° west and 3° east longitude, and between 30° and 44° north latitude, being about seven hundred miles in length from north to south; it is bounded by the bay of Biscay, on the north; by the Pyrenean mountains, which separate it from France, on the north-east; by the Mediterranean sea, on the south-east; and by the Atlantic ocean, on the west.

*New SPAIN*. See *MEXICO*.

**SPALATRO**, a city and port-town of Dalmatia, situated on the gulph of Venice: E. long. 17° 45', N. lat. 43° 16'.

**SPALDING**, a market-town of Lincolnshire, situated under the meridian of London, thirty miles south-east of Lincoln.

**SPAN**, a measure taken from the space between the thumb's end and the tip of the little finger, when both are stretched out. The span is estimated at three hand's breadths, or nine inches.

**SPANDAW**, a town of Germany, in the circle of Upper Saxony, and Marquisate of Brandenburg, situated on the river Havel, eight miles north-west of Berlin.

**SPANIEL**, in zoology. See *CANIS*.

**SPAR**, in natural history, a class of fossils, not inflammable nor soluble in water; when pure, it is pellucid and colourless, and emulating the appearance of crystal, but wanting its distinguishing characters; composed of plane and equable plates, not flexible nor elastic, not giving fire with steel, readily calcining in a small fire, and fermenting violently with acids, and wholly soluble in them.

The spars, in general, are found in the fissures of stones, and about mines. Derbyshire affords enough of them to supply the whole world; and the German mines afford yet larger quantities.

**SPARADRAPUM**, in pharmacy. &c. a sort of cere-cloth, called also tela Gualteri, the form whereof is directed as follows. Take of the diapalma plaster, and diachylon with the gums, each one pound; cerufs, half a pound; root of oris finely powdered, an ounce and a half. Mix these together; and whilst they are in fusion, dip them in soft worn-out linen-rags, so that they may be covered with the plaister on each side; then take them out, spread them, and let them dry; and smoothe the surfaces with

- a knife or spatula. The principal use of these is for issues.
- SPARGANIUM**, in botany, a genus of the monœcia triandria class. The amentum of both male and female is roundish; and the calix of both consists of three leaves; neither of them have any corolla; the stigma of the female is bifid; and the drupa is dry, and contains two seeds. There are two species, both natives of Britain, *viz.* the erectum, or great-bur-reed; and the natans, or least bur-reed.
- SPARROW**, in ornithology. See **FRINGILLA**.
- SPARROW-HAWK**, in ornithology. See **FALCO**.
- SPARTIUM**, in botany, a genus of the diadelphica decandria class. The stigma is longitudinal, and downy above; the laments adhere to the carina; and the calix is longest on the back part. There are 10 species, only one of them, *viz.* the scoparium, or common broom, a native of Britain.
- SPARTIVENTO CAPE**, the most southern point or promontory of Italy: situated in E. long. 16° 30', N. lat. 38° 20'.
- SPARUS**, in ichthyology, a genus belonging to the order of thoracici. The fore-teeth and dog-teeth are very strong; the grinders are obtuse, and thick set; the lips are folded over; there are five rays in the gill-membrane, and the opercula are scaly; the body is compressed; the lateral line is crooked behind; and the pectoral fins are roundish. There are 26 species.
- SPASM**, in medicine, a convulsion.
- A spasm, according to Hoffman, may be universal or particular, salutary or morbid. An universal spasm happens if the whole vascular genus, chiefly the heart and arteries, as also the fibres of the system are affected, and there is a preternatural constriction therein, whereby the systole and diastole are increased, and the progress of the blood accelerated; this constitutes a fever, whereof a frequent pulse is the most certain sign. See **MEDICINE**.
- SPASMODIC**, something belonging to a spasm or convulsion. See the last article.
- SPATHA**, in botany. See **BOTANY**, p. 636.
- SPAVIN**, in the manege, a disease in horses, being a swelling or stiffness, usually in the ham, occasioning a lameness. See **FARRIERY**, p. 572.
- SPAYING**, or **SPADING**, the operation of castrating the females of several kinds of animals, as sows, bitches, &c. to prevent any further conception, and promote their fattening.
- It is performed by cutting them in the mid flank, on the left-side, with a sharp knife or lancet, taking out the uterus and cutting it off, and so stitching up the wound, anointing the part with tar, and keeping the animal warm for two or three days. The usual way is to make the incision aslope two inches and a half long, that the forefinger may be put in towards the back to feel for the ovaries, which are two kernels as big as acorns on both sides of the uterus, one of which is drawn to the wound, the string thereof cut, and thus both taken out.
- SPEAKER** of the house of commons, a member of the house, elected by a majority of the votes thereof, to act as chairman or president in putting questions, reading briefs or bills, keeping order, reprimanding the refractory, adjourning the house, &c. See **PARLIAMENT**.
- SPEAKING**, the art or act of expressing one's thoughts in articulate sounds or words.
- SPECIAL**, something that is particular, or has a particular designation; from the Latin *species*, in opposition to general from *genus*.
- SPECIES**, in logic, a relative term, expressing an idea which is comprised under some general one called a genus, See **LOGIC** and **METAPHYSICS**.
- SPECIES**, in optics, the image painted on the retina, by the rays of light reflected from the several points of the surface of an object.
- SPECIES**, in commerce, are the several pieces of gold, silver, copper, &c. which having passed their full preparation and coinage are current in public. See **MONEY**.
- SPECIFIC**, in philosophy, that which is peculiar to any thing, and distinguishes it from all others.
- SPECIFIC** in medicine, a remedy whose virtue and effect is peculiarly adapted to some certain disease, is adequate thereto, and exerts its whole force immediately thereon.
- SPECIFICATION**, in Scots law. See **LAW**, Tit. viii. 7.
- SPECTACLES**, in dioptrics, a machine consisting of two lenses, set in silver, horn, &c. to assist the defects of the organ of sight.
- Old people, and others who have flat eyes, use convex spectacles, which cause the rays of light to converge so as to fall upon the retina: whereas myopes, or short-sighted persons, use concave lenses for spectacles, which causing the rays to diverge, prevent their meeting ere they reach the retina. See **OPTICS**.
- SPECULARIS LAPIS**, in natural history, a genus of talcs composed of large plates visibly separate, and of extreme thinness; and each fissile again separated into a number of plates still finer.
- Of this genus there are three species. 1. The white shining specularis, with large and broad leaves, commonly called ising-glass and Muscovy-glass: its lamellæ, or leaves, are extremely thin, elastic, and transparent; it makes not the least effervescence with aqua-fortis, and is not easily calcined in the fire. It is imported in great quantities: the miniature painters cover their pictures with it; the lantern-makers sometimes use it instead of horn: and minute objects are usually preserved between two plates of it, for examination by the microscope. 2. The bright brown specularis, with broad leaves; a very valuable species, though inferior to the former. 3. The purple bright specularis, with broad leaves; which is the most elegant of all the talcs, and not less beautifully transparent than the first kind.
- SPECULATIVE**, something relating to the theory of some art or science, in contradistinction to practical.
- SPECULUM**, a **LOOKING GLASS**, or **MIRROUR** capable of reflecting the rays of the sun, &c. See **OPTICS**.
- SPECULUM**, in surgery, an instrument for dilating a wound, or the like, in order to examine it attentively. See **SURGERY**.
- SPEECH**, in general, the art or act of expressing a person's thoughts, by means of articulate sounds, which we call words. See **LANGUAGE** and **GRAMMAR**.
- SPEEDWELL**, in botany. See **VERONICA**.
- SPELL**, in general, denotes the same with charm or amulet. See **CHARM** and **AMULET**.
- SPELLING**, in grammar, that part of orthography which teaches

- teaches the true manner of resolving words into their syllables. See GRAMMAR.
- SPERGULA**, in botany, a genus of the decandria pentagynia class. The calix consists of five leaves, and the corolla of five entire petals; the capsule is oval, with one cell and five valves. There are five species, three of them natives of Britain, *viz.* the *arvensis*, or corn-spurrey; the *pentandria*, or small spurrey; and the *nodosa*, or knotted spurrey.
- SPERM.** See SEED.
- SPERMA-CETI**, a white flaky substance, prepared from the oil of a species of whale, called *physeter macrocephalus*. See PHYSETER.
- SPERMACOCE**, in botany, a genus of the tetrandria monogynia class. The corolla consists of one funnel-shaped petal; and it has two bidentated seeds. There are six species, none of them natives of Britain.
- SPERMATIC**, in anatomy, something belonging to the sperm or seed. See ANATOMY, p. 270.
- SPEY**, a river of Scotland, which, running north-east, through Badenoch and Murray, falls into the German sea, east of the frith of Murray.
- SPHACELUS**, in surgery and medicine, an absolute and perfect corruption or death of the parts. See MEDICINE and SURGERY.
- SPHERANTHUS**, in botany, a genus of the syngenesia polygamia segregata class. The receptacle is naked; it has no pappus; the calix is imbricated. There are two species, none of them natives of Britain.
- SPHAGNUM**, in botany, a genus of the cryptogamia muscorum class. The antheræ are operculated, and there is no calyptra. The species are three, all natives of Britain, *viz.* the *pálustre*, or grey bog-moss; the *alpinum*, or mountain bog-moss; and the *arborescens*, or creeping bog-moss.
- Or* **SPHENOIDES**, in anatomy. See ANATOMY, p. 158.
- SPHERE**, is a solid contained under one uniform round surface, such as would be formed by the revolution of a circle about a diameter thereof, as an axis. See GEOMETRY, and ASTRONOMY.
- SPHEROID**, in geometry, a solid, approaching to the figure of a sphere.
- The spheroid is generated by the entire revolution of a semi-ellipsis about its axis.
- SPHINCTER**, in anatomy, a term applied to a kind of circular muscles, or muscles in form of rings, which serve to close and draw up several orifices of the body, and prevent the excretion of the contents.
- SPHINX**, in sculpture, &c. a figure or representation of a monster of that name, famed among the ancients, now mostly used as an ornament in gardens, terraces, &c. It is represented with the head and breasts of a woman, the wings of a bird, the claws of a lion, and the rest of the body like a dog.
- SPICA VIRGINIS**, a star of the first magnitude, in the constellation virgo. See ASTRONOMY, p. 487.
- SPICE**, any kind of aromatic drug that has hot and pungent qualities: such are pepper, nutmeg, ginger, cinnamon, cloves, &c.
- SPICE-ISLANDS** situated in the East Indies. See BANDA, MOLUCCA-ISLANDS, and CEYLON.
- SPIDER**, in zoology. See ARANEA.
- SPIDER-WORT**, in botany. See PHALANGIUM.
- SPIEL**, in the glass-trade, an iron instrument, hooked at the end, and pointed, with which the workmen take the metal up out of the melting-pots, for proofs or essays, to see whether it be fit for work.
- SPIGELBURG**, a town of Germany, in the circle of Westphalia, capital of the county of Spigelburg: E. long.  $9^{\circ} 25'$ , N. lat.  $52^{\circ} 6'$ .
- SPIGELIA**, in botany, a genus of the pentandria monogynia class. The corolla is funnel-shaped; and the capsule has two cells, and containing many seeds.
- SPIKE**, or *oil of SPIKE*, a name given to an essential oil distilled from lavender, and much used by the varnish-makers and the painters in enamel.
- SPIKENARD**, in botany. See NARDUS.
- Ploughman's SPIKENARD*, in botany. See COMYZA.
- SPLIMBERGO**, a town of Italy, in the territory of Venice, and province of Friuli: situated forty-five miles north of Venice.
- SPILSBY**, a market-town of Lincolnshire: situated twenty-seven miles east of Lincoln.
- SPINA VENTOSA**, in surgery, that species of corruption of the bones which takes its rise in the internal parts, and by degrees enlarges the bone, and raises it into a tumour. See SURGERY.
- SPINACHIA**, in botany, a genus of the dioecia pentandria class. The calix of the male consists of five segments, and that of the female of four; neither of them have any corolla; the styli are four; and there is one hard seed within the calix. The species are two, none of them natives of Britain.
- SPINAL MARROW**. See ANATOMY, p. 288.
- SPINALIS** in anatomy, the names of several muscles, &c. See ANATOMY, p. 195 &c.
- SPINE** *SPINA DORSI*, in anatomy. See ANATOMY, p. 166.
- SPINET**, or *SPINNET*, a musical instrument, ranked in the second or third place among harmonious instruments.
- SPINNING**, the art or art of reducing silk, flax, hemp, wool, hair, or other matters, into thread. Spinning is either performed on the wheel with a distaff and spindle, or with other machines proper for the several kinds of working. Hemp, flax, nettle-thread, and the like vegetable matters, are to be wetted in spinning; silks, wools, &c. are to be spun dry, and do not need water; but there is a way of spinning silk as it comes off the cafes or balls, where hot and even boiling water is to be used.
- SPINOZISM**, the doctrine of Spinoza, or atheism and pantheism proposed after the manner of Spinoza, who was born a Jew at Amsterdam.
- The great principles of Spinozism, is, that there is nothing properly and absolutely existing besides matter and the modifications of matter; among which are even comprehended thought, abstract and general ideas, comparisons, relations, combinations of relations, &c.
- The chief articles in Spinoza's system are reducible to these. That there is but one substance in nature; and that this only substance is endued with an infinite number of attributes, among which are extension and cogitation: that all the bodies in the universe are modifications of this substance considered as it is extended and that all the souls of men are modifications of the same substance considered as cogitative: that God is a necessary and infinitely perfect Being, and is the cause of all things that exist,

- exist, but not a different being from them : that there is but one being and one nature, and that this nature produces within itself, by an immanent act, all those which we call creatures ; and that this being is at the same time both agent and patient, efficient cause and subject, but that he produces nothing but modifications of himself.
- SPIRÆA**, in botany, a genus of the icosantria pentagynia class. The calix consists of five segments, and the corolla of five petals; and the capsule contains many seeds. There are eleven species, none of them natives of Britain.
- SPIRAL**, in geometry, a curve line of the circular kind, which, in its progress, recedes from its center.
- SPIRAL**, in architecture and sculpture, implies a curve that ascends, winding about a cone or spire, so as all the points thereof continually approach the axis. It is distinguished from the helix, by its winding around a cone, whereas the helix winds in the same manner around a cylinder.
- SPIRE**, in architecture, was used by the ancients for the base of a column, and sometimes for the astragal or torse. But among the moderns, it denotes a steeple that continually diminishes as it ascends, whether conically or pyramidally.
- SPIRE**, in geography, an imperial city of Germany, capital of a bishopric of the same name, and situated in the palatinate of the Rhine, fifteen miles south-west of Heidelberg: E. long. 8° 17', N. lat. 49° 16'.
- SPIRIT**, in metaphysics, an incorporeal being or intelligence; in which sense, God is said to be a spirit, as are angels and the human soul.
- SPIRITS**, or **ANIMAL SPIRITS**, in physiology. See **ANATOMY**, p. 253, and **ÆTHER**.
- SPIRIT**, in chemistry, a name applied to several very different substances. However, in general, it denotes any distilled volatil liquor that is not insipid, as phlegm, or pure water, not inflammable as oil: but under this general idea are comprehended liquors of quite opposite natures, some being acid, and others alkaline; which last are such enemies to the former, that as soon as they are put together, they raise a violent effervescence, and grow hot: and to these may be added a third sort, called vinous or inflammable spirits; which, though very subtle or penetrating, are not manifestly either acid or alkaline. See **CHEMISTRY**, p. 69, 95, 161, &c.
- SPIRITUAL**, in general, something belonging to, or partaking of, the nature of spirit. See **SPIRIT**.
- SPIRITUALITIES** of a bishop, are the profits he receives as a bishop, and not as a baron of parliament: such are the duties of his visitation, presentation money, what arises from the ordination and institution of priests, the income of his jurisdiction, &c.
- SPITHEAD**, a road between Portsmouth and the isle of Wight, where the Royal navy of Great Britain frequently rendezvous.
- SPITTLE**, in physiology. See **SALIVA**.
- SPITZBERGEN**. See **GROENLAND**.
- SPLACHNUM**, in botany, a genus of the cryptogamia musci class. The calix of the male flower is a smooth conic calyptra; the antheræ are cylindric; and the receptacle coloured, membranaceous, and very large. There are four species, only one of them, *viz.* the ampullaceum, or common splachnum, a native of Britain.
- SPLEEN**, in anatomy. See **ANATOMY**, p. 266.
- SPLEEN-WORT**. See **ASPLENUM**.
- SPLENE TIC**, a person affected with obstruction of the spleen.
- SPLENIUS**, in anatomy. See **ANATOMY**, p. 216.
- SPLENT**, or **SPLINT**, among farmers, a callous, insensible excrescence, breeding on the Shank bone of horses. See **FARRIERY**, p. 573.
- SPLICING**, in the sea-language, is the untwisting the ends of two cables or ropes, and working the several strands into one another by a fidd, so that they become as strong as if they were but one rope.
- SPODIUM**, in pharmacy, one of the foulest recrements of copper.
- SPOILS**, whatever is taken from the enemy in time of war. Among the ancient Greeks, the spoils were divided in common among the whole army; only the general's share was largest: but among the Romans, the spoils belonged to the republic.
- SPOLETTO**, the capital of Umbria, in Italy: it is situated fifty miles north-east of Rome.
- SPONDEE**, in ancient poetry, a foot consisting of two long syllables; as, *omnes*.
- SPONDIAS**, in botany, a genus of the decandria pentagynia class. The calix has five teeth, and the corolla five petals; and the drupa has five cells. There are two species, both natives of America.
- SPONGIA**, in zoology, a genus belonging to the order of vermes zoophyta. The whole texture is a congeries of bibulous cells. There are six species, all found in the bottom of the sea, and submarine rocks. Sponges are much used by surgeons, and others, for sucking up superfluous moisture; which they easily part with by pressure.
- SPONSORS**, among Christians, are those persons, who, in the office of baptism, answer or are sureties for the persons baptized.
- SPONTANEOUS**, a term applied to such motions of the body, and operations of the mind, as we perform of ourselves, without any constraint.
- SPOON-BILL**, in ornithology. See **PLATEA**.
- SPOONING**, in the sea-language, is said of a ship, which, being under sail in a storm at sea, is unable to bear it, and consequently forced to put right before the wind.
- SPORADES**, among ancient astronomers, a name given to such stars as were not included in any constellation.
- SPORADIC DISEASES**, among physicians, are such as seize particular persons at any time or season, and in any place; in which sense they are distinguished from epidemical and endemic diseases.
- SPOTS**, in astronomy, certain places of the sun's or moon's disc, observed to be either more bright, or darker, than the rest; and accordingly, called *faculæ* and *maculæ*. See **ASTRONOMY**.
- SPOUT**, or **WATER-SPOUT**, an extraordinary and dangerous meteor, observed at sea, and sometimes at land, called by the Latins *typho* and *sipho*. Its first appearance is in form of a deep cloud, the upper part of which is white, and the lower black: then from the lower part of this cloud hangs, or rather falls down, what is properly called the spout, in form of a conical tube, biggled at top; and under this tube, there is always a great boiling,

boiling and flying up of the water of the sea, as in a *jet d'eau*. For some yards above the surface of the sea, the water stands as a column or pillar, from the extremity whereof it spreads and goes off, as in a kind of smoke. Frequently, the cone descends so low, as to touch the middle of this column, and continue for some time contiguous to it; though sometimes it only points to it, at some distance, either in a perpendicular or oblique line. Frequently it is scarce distinguishable whether the cone or the column appear the first, both appearing all of a sudden against each other. But sometimes the water boils up from the sea to a great height, without any appearance of a spout pointing to it, either perpendicularly or obliquely. Indeed, generally, the boiling or flying up of the water has the priority, this always preceding its being formed into a column. Generally, the cone does not appear hollow, till towards the end, when the sea-water is violently thrown up along its middle, as smoke up a chimney. Soon after this, the spout or canal breaks and disappears; the boiling up of the water, and even the pillar, continuing to the last, and for some time afterwards; sometimes till the spout form itself again, and appear anew; which it sometimes does several times in a quarter of an hour.

M. de la Pyme, from a near observation of two or three spouts in Yorkshire, described in the Philosophical Transactions, gathers, that the water-spout is nothing but a gyration of clouds by contrary winds, meeting in a point or centre; and there, where the greatest condensation and gravitation is, falling down into a pipe or great tube, somewhat like Archimedes's spiral screw; and, in its working and whirling motion, absorbing and raising the water, in the same manner as the spiral screw does; and thus destroying ships, &c.

SPRAT, in ichthyology. See CLUPEA.

SPRING, in natural history, a fountain or source of water, rising out of the ground. See HYDROSTATICS.

SPRING, in mechanics, denotes a thin piece of tempered steel, or other elastic substance; which, being wound up, serves to put several machines in motion by its elasticity, or endeavour to unbend itself: such is the spring of a clock, watch, and the like.

SPRING-TIDE. See ASTRONOMY, p. 473, &c.

SPUNGE. See SPONGIA.

SPUNGING, in gunnery, the cleaning a gun's inside with a sponge, in order to prevent any sparks of fire from remaining in her, which would endanger the life of him who should load her again.

SPUN YARN, among sailors, is a kind of line made from rop yarn, and used for seizing or fastening things together.

SPUR, a piece of metal, consisting of two branches encompassing a horseman's heel, and a rowel in form of a star, advancing out behind to prick the horse.

SPURGE, in botany. See EUPHORBIA.

SPURGE LAUREL. See DAPHNE.

SPURKE'S, in a ship, spaces between the upper and lower futtocks, or betwixt the rungs fore and aft.

SPURRY, in botany. See SPERGULA.

SPUTUM, among physicians, denotes the same with the saliva or spittle. See SALIVA.

SPY, a person hired to watch the actions, motions, &c.

of another; particularly of what passes in a camp. When a spy is discovered, he is hanged immediately.

SQUADRON, in military affairs, denotes a body of horse whose number of men is not fixed; but is usually from one to two hundred.

SQUADRON of ships, a division or part of a fleet, commanded by a vice-admiral, or commodore.

SQUALUS, the SHARK KIND, in ichthyology, a genus belonging to the order of amphibia nantes. There are five spiracula, one on each side of the neck; the body is oblong, and somewhat cylindrical; and the mouth is situate in the anterior part of the head. There are 15 species, all inhabitants of the ocean.

SQUAMARIA, in botany. See LATHRÆA.

SQUAMOUS, in anatomy, an appellation given to the spurious or false sutures of the skull, because composed of squamæ or scales like those of fishes. See ANATOMY, p. 152.

SQUARE, in geometry, a quadrilateral figure, both equilateral and equiangular. See GEOMETRY.

SQUARE ROOT. See ARITHMETICK, p. 420.

Hollow SQUARE, in the military art, is a body of foot drawn up with an empty space in the middle for the colours, drums, and baggage; faced and covered by the pikes every way, to keep off horse.

SQUARE, an instrument consisting of two rules, or branches, fastened perpendicularly at one end of their extremes, so as to form a right angle: it is of great use in the description and mensuration of right angles, and laying down perpendiculars.

SQUATINA. See SQUALUS.

SQUILL, in botany. See SCILLA.

SQUINTING. See STRABISMUS.

SQUIRREL, in zoology. See SCIURUS.

STABLE, a place or house for horses, &c. furnished with stalls and proper apartments to contain their food, &c.

STACHYS, in botany, a genus of the didynamia gymnospermia class. The upper labium is vaulted, and the inferior one reflected in the edges; the intermediate labium being largest, and emarginated; and the lamina are reflected towards the sides. There are 12 species, three of them natives of Britain, viz. the germanica, or bafe horse-hound; the silvatica, or hedge-nettle; and the palustris, or clown's all heal.

STADIUM, an ancient Greek long measure.

Stadium was also the course or career wherein the Greeks ran their races.

STADTHOLDER, the principal governor or magistrate of the United Provinces.

The stadtholder seems to be empowered, either directly or by his influence, to change both the deputies, magistrates, and officers, in every province and city. He is president in the states of every province, though he has not so much as a seat or vote in the states-general: but as he influences the states of each province to send what deputies he pleases to the states-general, he has, in effect, the appointing the persons that constitute the states-general, and may be deemed sovereign of the united provinces. The stadtholders had once a very great power. We find one of their stadtholders appointing what towns should send deputies or members to the assembly of the states of Holland: but the stadtholdership was never hereditary till now, when in the year 1747 it was made so in the family of Orange.

- It is observed, that the states passed by the stadtholder's eldest son, and appointed his younger son prince Maurice of Orange their stadtholder; and at other times they have suppressed the stadtholdership entirely. The stadtholder always in the council of state, when the votes happen to be equal, has a decisive voice.
- STAEHELINA**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; the pappus is feathered; and the calix is imbricated with scales, membranaceous, coloured, and reflected at the points. There are two species, none of them natives of Britain.
- STAFF**, an instrument ordinarily used to rest on in walking. The staff is also frequently used as a kind of natural weapon both of offence and defence, and for several other purposes.
- STAFF**, in musick, five lines on which with the intermediate spaces the notes of a song or piece of musick are marked.
- STAFFORD**, the county-town of Staffordshire, is situated one hundred and thirty miles north-west of London. It sends two members to parliament.
- STAG**, in zoology. See **CERVUS**.
- STAGE**, in the modern drama, the place of action and representation, included between the pit and the scenes, and answering to the proscenium or pulpitum of the ancients.
- STAGGERS**. See **FARRIERY**, p. 552.
- STAINES**, a town of Middlesex, situated nineteen measured miles west of London.
- STAIR-CASE**, in architecture, an ascent inclosed between walls, or a ballustrade, consisting of stairs, or steps, with landing-places and rails, serving to make a communication between the several stories of a house. See **ARCHITECTURE**, p. 360.
- STALACTITÆ**, in natural history, crystalline spars formed into oblong, conical, round, or irregular bodies, composed of various crusts, and usually found hanging in form of icicles from the roofs of grottos, &c.
- STALBRIDGE**, a market-town of Dorsetshire, situated eighteen miles north of Dorchester.
- STALK**, in botany, that part of a plant which rises immediately from the root, and which supports the leaves of the flowers and the fruit.
- STALLION**, or **STONE-HORSK**, in the menage; an ungelit horse, designed for the covering of mares, in order to propagate the species. See **EQUUS**.
- STAMFORD**, a borough-town of Lincolnshire, situated thirty-five miles south of Lincoln. It sends two members to parliament.
- STAMINA**. See **BOTANY**, p. 635.
- STAMINA**, in the animal body, are defined to be these simple original parts, which existed first in the embryo, or even in the seed; and by whose distinction, augmentation, and accretion, by additional juices, the animal body, at its utmost bulk, is supposed to be formed.
- STAMINEOUS**, in botany, a term for those flowers of plants which have no petals or flower-leaves, but consist only of a number of stamina and pistils placed in a cup.
- STAMP-DUTIES**, certain impositions laid on all parchment and paper, on which deeds, grants, or other instruments, or any process in law or equity, are ingrossed or written. These duties, when first granted, were from forty shillings for letters-patent, &c. to sixpence for the usual deeds; and one penny for declarations, pleadings, &c. They have been, in general, doubled and trebled, by subsequent statutes; and the common stamp now is the treble sixpenny. Persons writing or engrossing any thing charged with the duty on parchment or paper, before it is stamped, or if it be marked with any lower duty than what is required, are liable to forfeit 5 l.; and the deed shall not be deemed good in law, till such penalty is paid, and the same be stamped, &c.
- STAMPALIA**, an island of the Archipelago, about fifty miles in circumference, situated in E. long. 26° 30', and N. lat. 36° 20'.
- STANCHION**, or **STANCHIONS**, in a ship, those pillars, which being set up pillar-wise, do support and strengthen the waste-trees.
- STAND**, in commerce, a weight, from two hundred and a half to three hundred, of pitch.
- STANDARD**, in war, a sort of banner, or flag, borne as a signal for the joining together of the several troops belonging to the same body. See **FLAG**, &c.
- STANDARD**, in commerce, the original of a weight; measure, or coin, committed to the keeping of a magistrate, or deposited in some public place, to regulate, adjust, and try the weights used by particular persons in traffick. See **MONEY**.
- STANDON**, a town of Hertfordshire, situated under the meridian of London, and seven miles north of Hertford.
- STANHOPE**, a market-town of Durham, situated sixteen miles west of Durham.
- STANLEY**, a town of Gloucestershire, situated twelve miles south of Gloucester.
- STANNARIES**, the mines and works where tin is dug and purified, as in Cornwall, Devonshire, &c. There are four courts of the stannaries in Devonshire, and as many in Cornwall; and great liberties were granted them by several acts of parliament in the time of Edward I. &c. though somewhat abridged under Edward III. and Charles I.
- STANNUM, TIN**. See **CHEMISTRY**, p. 83, 135.
- STANTON**, a town of Lincolnshire, situated seventeen miles east of Lincoln, under the meridian of London.
- STANZA**, in poetry, a certain stated number of verses, generally containing a perfect sense, that ought to end with some lively and ingenious thought, or just and pertinent reflection.
- STAPELIA**, in botany, a genus of the pentandria digynia class of plants. The plant is contorted, with a double star-like nectarium covering the fructification. There are two species, both natives of the Cape of Good Hope.
- STAPES**, in anatomy. See **ANATOMY**, p. 296.
- STAPHYLÆA**, in botany, a genus of the pentandria trigynia class. The calix consists of five segments, and the corolla of five petals; the capsules are inflected and connate; and there are two globular seeds. There are two species, both natives of the Cape of Good Hope.
- STAPHYLINUS**, in zoology, a genus of insects belonging to the order of coleoptera: the antennæ are slender; the elytra are dimidiated, and cover the wings; and the tail is simple, and furnished with two oblong bladders. There are 17 species, principally distinguished by their colour.
- STAPLE** primarily signifies a public place or market, whither

ther merchants, &c. are obliged to bring their goods to be bought by the people, as the Greve, or the places along the Seine, for sale of wines and corn, at Paris, whether the merchants of other parts are obliged to bring those commodities.

Formerly the merchants of England were obliged to carry their wool, cloth, lead, and other like staple-commodities of this realm, in order to utter the same by wholesale; and these staples were appointed to be constantly kept at York, Lincoln, Newcastle upon Tyne, Norwich, Westminster, Canterbury, Chichester, Winchester, Exeter, and Bristol; in each whereof a public mart was appointed to be kept, and each of them had a court of the mayor of the staple, for deciding differences, held according to the law-merchant, in a summary way.

STAR, in astronomy. See *ASTRONOMY, passim*.

Falling STARS, in meteorology, fiery meteors, which dart through the sky, in form of a star; being occasioned by a nitro-sulphureous matter, the common cause of all such meteors.

STAR, in heraldry, a charge frequently borne on the shield, and the honourable ordinaries, in figure of a star; which differs only from the mullet, in not being pierced as this last is. See *MULLET*.

STAR, is also a badge of honour, worn by the knights of the garter, bath, and thistle. See *GARTER*.

STAR of *Bethlehem*, in botany. See *ORNITHOGALUM*.

STAR-BOARD, in the sea-language, denotes the right-hand side of a ship: thus they say, star-board the helm, or helm a star-board, when he that commands would have the men at the helm, or steering-wheel, put the helm to the right-side of the ship.

STAR-CHAMBER, a chamber at Westminster, so called from having its roof painted with gilt stars, wherein the chancellor, assisted by others appointed for that purpose, formerly had authority to punish routs, riots, and other misdemeanors that were not by the common law provided against.

STAR-FISH. See *ASTERIAS*

STAR-SHOT, a gelatinous substance frequently found in fields, and supposed by the vulgar to have been produced from the meteor called a falling star; but, in reality, is the half-digested food of herons, sea-mews, and the like birds; for these birds, when shot, have been found, when dying, to discharge a substance of the same kind.

STAR-STONE, in natural history, a name given to certain extraneous fossil stones, in form of short and commonly somewhat crooked, columns, composed of several joints; each resembling the figure of a radiated star, with a greater or smaller number of rays in the different species: they are usually found of about an inch in length, and of the thickness of a goose-quill. Some of them have five angles, or rays, and others only four, and in some the angles are equidistant, while in others they are irregularly so; in some also they are short and blunt, while in others they are long, narrow, and pointed; and some have their angles so very short and obtuse, that at first sight they might be taken for entrochoasteria. The several joints in the same specimen are usually all of the same thickness; this however is not always the case, but in some they are larger at one end, and in others at the middle, than in any other part of the body; and some species have one of the

rays bifid; so as to emulate the appearance of a six-rayed kind.

STAR-THISTLE. See *CENTAUREA*.

STAR-WORT. See *ASTER*.

STAR-ARCH, a fecula, or sediment, found at the bottom of vessels wherein wheat has been steeped in water; of which fecula, after separating the bran from it, by passing it through sieves, they form a kind of loaves, which being dried in the sun or an oven, is afterwards cut into little pieces, and so sold. The best starch is white, soft, and friable, and easily broken into powder. Such as require fine starch do not content themselves, like the starch-men, with refuse wheat, but use the finest grain. The process is as follows: The grain being well cleaned is put to ferment in vessels full of water, which they expose to the sun while in its greatest heat, changing the water twice a-day, for the space of eight or twelve days, according to the season. When the grain bursts easily under the finger, they judge it sufficiently fermented. The fermentation perfected, and the grain thus softened, it is put, handful by handful, into a canvas bag, to separate the flour from the husks, which is done by rubbing and beating it on a plank laid across the mouth of an empty vessel that is to receive the flour.

As the vessels are filled with this liquid flour, there is seen swimming at the top redish water, which is to be carefully scummed off from time to time, and clean water is to be put in its place; which, after stirring the whole together, is also to be strained through a cloth or sieve, and what is left behind put into the vessel with new water, and exposed to the sun for some time. As the sediment thickens at the bottom, they drain off the water four or five times, by inclining the vessel, but without passing it through the sieve. What remains at bottom is the starch, which they cut in pieces to get out, and leave it to dry in the sun. When dry, it is laid up for use.

STARGARD, a town of Germany, in the circle of Upper-Saxony, and duchy of Pomerania, situated twenty miles east of Stetin.

STARIA, a city of Russia, in the province of Great Novogorod, situated at the south end of the Ilmen-lake: E. long.  $34^{\circ} 2'$ , N. lat.  $58^{\circ}$ .

STARLING. See *STURNUS*.

START-POINT, a cape or promontory of Devonshire, in the English channel, twelve miles south of Dartmouth.

STATE, or *ESTATE*, an empire, kingdom, province, or extent of country under the same government.

STATEN ISLAND, an island of the province of New York, in North America, situated near the mouth of Hudson's river: in W. long.  $72^{\circ} 31'$ , N. lat.  $41^{\circ}$ .

STATERA ROMANA, or *STEEL-YARD*, a name given to the Roman balance.

STATES, or *ESTATES*, a term applied to several orders or classes of people assembled to consult of matters for the public good.

Thus states-general is the name of an assembly consisting of the deputies of the seven United Provinces: these are usually thirty in number, some provinces sending two, others more; and whatever resolution the states-general take, must be confirmed by every province, and by every city and republic in that province, before it has the force of a law. The deputies of each province, of what number soever they be, have only one voice, and are esteemed

es but one person, the votes being given by provinces. Each province presides in the assembly in its turn, according to the order settled among them. Guelderland presides first, then Holland, &c.

States of Holland are the deputies of eighteen cities, and one representative of the nobility, constituting the states of the province of Holland: the other provinces have likewise their states, representing their sovereignty, deputies from which make what they call the states-general. In an assembly of the states of a particular province, one dissenting voice prevents their coming to any resolution.

**STATICE**, in botany, a genus of the pentandria trigynia class. The calix is one entire plaited leaf; the corolla consists of five petals; it has but one seed. There are 14 species, three of them natives of Britain, viz. the armeria, or sea gilly-flower; the limonium, or sea-lavender; and the reticulata, or matted sea-lavender.

**STATICS**, that branch of mathematics which considers the motion of bodies arising from gravity. See **HYDROSTATICS**, and **MECHANICS**.

**STATION**, in geometry, surveying, &c. a place pitched upon to make an observation, take an angle, or the like.

**STATIONARY**, in astronomy, signifies the appearance of a planet, when it seems to remain immovable on the same point of the zodiac for several days. See **ASTRONOMY**.

**STATIONARY-DAYS**, in church-history, an appellation given to the weekly fast-days, viz. Wednesdays, and Fridays; otherwise called half-fasts, and fasts of the fourth and sixth days of the week.

These fasts are certainly as ancient as Clemens Alexandrinus and Tertullian, who both mention them; and the reason of their institution is, because on the fourth day of the week the Jews took council to put our Saviour to death, which was actually accomplished on the sixth; however, being in continual use throughout the year, they were not kept with such rigour and strictness as Lent. See the article **LENT**.

**STATIVA**, among the Romans, a standing camp kept for the defence of the frontiers of the empire. These camps gave rise to a great many towns, which took their names from the legion stationed there.

**STATUARY**, a branch of sculpture, employed in the making of statues. See **SCULPTURE**, and the next article.

Statuary is one of those arts wherein the ancients surpassed the moderns; and indeed it was much more popular, and more cultivated, among the former than the latter.

**STATUE**, is defined to be a piece of sculpture in full relief, representing a human figure.

Statues are formed with the chissel of several matters, as stone, marble, plaster, &c. They are also cast of various kinds of metals, particularly gold, silver, brass, and lead.

Every statue, resembling the person it is intended to represent, is called *statua iconica*. Statues acquire various other denominations. 1. Thus allegorical statue, is that which, under a human figure, or other symbol, represents something of another kind, as a part of the earth, a season, age, element, temperament, hour, &c. 2. Curule statues, are those which are represented in chariots drawn by bigæ, or quadrigæ, that is, by two or four horses; of which kind there were several in the circuses, hippodromes, &c. or in cars, as we see some, with triumphal

arches, on antique medals. 3. Equestrian statue, that which represents some illustrious person on horse-back, as that famous one of Marcus Aurelius, at Rome; that of king Charles I. at Charing-cross, king George II. in Leicester-square, London; king Charles II. in the Parliament-clofe, Edinburgh; king William III. at the cross, Glasgow; &c. 4. Greek statue, denotes a figure that is naked and antique; it being in the manner the Greeks represented their deities, athletes of the olympic games, and heroes: statues of the heroes were particularly called Achillean statues, by reason of the great number of figures of that prince in most of the cities of Greece.

5. Hydraulic statue, is any figure placed as an ornament of a fountain or grotto, or that does the office of a jet d'eau, a cock, spout, or the like, by any of its parts; the like is to be understood of any animal serving for the same use. 6. Pedestrian statue, a statue standing on foot; as that of king George II. in the royal infirmary, Edinburgh; that of king Charles II. in the royal-exchange, London; and of king James II. in the privy-Gardens. 7. Roman statue, is an appellation given to such as are clothed, and which receive various names from their various dresses. Those of emperors, with long gowns over their armour, were called *statue paludate*: those of captains and cavaliers, with coats of arms, *thoracate*: those of soldiers, with cuirasses, *lo-cate*: those of senators and augurs, *trabeate*: those of magistrates, with long robes, *togate*: those of the people, with a plain tunica, *tunicate*: and lastly, those of the women, with long trains, *stolate*. The Romans had another division of statues into divine, which were those consecrated to the gods, as Jupiter, Mars, Apollo, &c.; Heroes, which were those of the demi-gods, as Hercules, &c.; and Augusti, which were those of the emperors, as those two of Cæsar and Augustus under the portico of the capitol. In repairing a statue cast in a mould, they touch it up with a chissel, graver, or other instrument, to finish the places which have not come well off: they also clear off the barb, and what is redundant in the joints and projectures.

**STATURE**, the size or height of a man.

**STATUTE**, in its general sense, signifies a law, ordinance, decree, &c. See **LAW**, &c.

Statute, in our laws and customs, more immediately signifies an act of parliament made by the three estates of the realm: and such statutes are either general, of which the courts at Westminster must take notice, without pleading them; or they are special and private, which last must be pleaded.

**STAVANGER**, a port-town of Norway, in the province of Bergen, capital of the territory Stavanger, situated on a peninsula in the German ocean: E. long. 6° 30', N. lat. 59° 30'.

**STAVEREN**, a port-town of the United-Netherlands, in the province of West Friesland, situated on the Zuyder-sea: E. long. 5° 12', N. lat. 53°.

**STAY**, in the sea-language, a big strong rope fastened to the top of one mast, and to the foot of that next before it towards the prow, serving to keep it firm, and prevent its falling aftwards or towards the poop.

**STEADY**, a word of command at sea, for the man at the helm to keep the ship steady in her course, and not to make angles (or yaws, as they call them) in and out.

**STEATITES**, in the history of fossils, a name given by late

late authors, to a substance called, in English, soap-earth. Dr Woodward much recommends it as a substance for making porcelain; and repeated trials of it have been made since his time, and some of them very lately; in all which it has afforded the finest earthen-ware ever made with us, and promises fair, with good management, for the equaling any in the world. It is dug in many parts of Devonshire and Cornwall, and the neighbouring counties; the cliff of the Lizard-point is almost wholly composed of it, and the adjacent little islands abound with it; and from all these places it might be brought, at a small expence, in any quantities. It is known from all other earths by these characters: it is composed of extremely fine particles; and is of a firm, equal and regular texture, and a great weight. It is very firm and hard as it lies in the earth, but when it has been some time exposed to the air, it becomes almost of a stony hardness. It is of a perfectly fine, smooth, and glossy surface, softer to the touch than any other species of earth, and does not at all adhere to the tongue, or stain the fingers in handling; but drawn along a rough surface, as a piece of cloth, or the like, it marks it with a fine and even white line. In colour it is a clear white, veined and variegated very beautifully with purple of different degrees of deepness; and is of so fine a structure of parts, that when cut into thin pieces, it is in some degree transparent. It makes no effervescence with acids, and burns to a pure white, even in its purple parts.

**STEATOMA**, a kind of encysted tumour, consisting of a matter like suet or lard, soft, without pain, and without discolouring the skin.

**STEEL**, a kind of iron refined and purified by the fire with other ingredients. See **CHEMISTRY**, p. 134.

**STEEL GLASSES**, a name given by some authors to the metalline spheres used in optics. These, according to Cardan, are made of three parts of brass, one part of tin, and one of silver, with an eighteenth part of antimony; but most either totally leave out the silver, or add only a twenty-fourth part, to save the expence. There are many other methods, directed by several authors; but most use arsenic and tartar mixed with the metals. These are afterwards to be polished with emery, rotten-stone, putty, and the like.

**STEEL-YARD**. See **MECHANICS**.

**STEEPLE**, an appendage erected generally on the western end of a church, to hold the bells. Steeples are denominated from their form, either spires or towers; the first are such as ascend continually diminishing either conically or pyramidically; the latter are mere parallelepipeds, and are covered a top platform-like.

**STEERAGE**, on board a ship, that part of the ship next below the quarter-deck, before the bulk-head of the great cabin, where the steersman stands in most ships of war. See the next article.

**STEERING** in navigation, the directing a vessel from one place to another by means of the helm and rudder. He is held the best steersman who causes the least motion in putting the helm over to and again, and who best keeps the ship from making yaws, that is, from running in and out. See **NAVIGATION**.

**STEEVE** on board a ship. The seamen say the bowsprit or the beak head of a ship steeves, when it stands too upright, or not straight enough forward.

**STEGANIUM**. See **SLATE**.

**STEGANOGRAPHY**, the art of secret writing, or of writing in cyphers known only to the persons corresponding.

**STEGEBURG**, a port-town of Sweden, in the province of East Gothland, situated on a bay of the Baltic: E. long. 16°, N. lat. 58° 30'.

**STEGNOTICS**, in medicine, remedies proper to close and stop the orifices of the vessels or emunctories when relaxed, stretched, lacerated, &c. such as pomegranate-leaves and roses, plaitain-leaves, tormentil-roots, &c.

**STELLATE**, among botanists, expresses leaves which grow not less than six at a joint, and are arranged like the rays of a star.

**STELLERA**, in botany, a genus of the octandria monogynia class. It has no calix, the corolla consists of four segments; the stamina are very short; and there is but one rostrated seed. There are two species, none of them natives of Britain.

**STELLIONATE**, in Scots law. See **LAW**, Tit. xxxiii. 36.

**STEM**, in botany, that part of a plant arising out of the root, and which sustains the leaves, flowers, fruits, &c.

**STEM of a ship**, that main piece of timber which comes bending from the keel below, where it is scarfed, as they call it; that is, pieced in; and rises compassing right before the fore-castle. This stem it is which guides the rake of the ship, and all the butt-ends of the planks are fixed into it. This, in the section of a first-rate ship, is called the main stem.

**STEMPLES**, in mining, cross-bars of wood in the shafts which are sunk to mines. In many places the way is to sink a perpendicular hole or shaft, the sides of which they strengthen from top to bottom with wood-work, to prevent the earth from falling in: the transverse pieces of wood used for this purpose, they call stemples; and by means of these the miners, in some places, descend without using any rope, catching hold of these with their hands and feet.

**STENOGRAPHY**, the art of writing short-hand. See **SHORT-HAND WRITING**.

**STENONIAN DUCT**, in anatomy. See **ANATOMY**, p. 307.

**STEP of the mast and capstan**, in a ship, is that piece of timber whereon the masts or capstans do stand at bottom.

**STEPHEN**, or *St. STEPHEN'S DAY*, a festival of the Christian church, observed on the 26th of December, in memory of the first martyr St. Stephen.

**STERCULIA**, in botany, a genus of the monœcia monodelphia class. The calix both of male and female consists of five segments; neither of them have any corolla: the male has 15 filaments; the germen rests upon a column; and there are five capules containing many seeds. There are two species, both natives of India.

**STEREOGRAPHIC PROJECTION**, is the projection of the circles of the sphere on the plane of some one great circle, the eye being placed in the pole of that circle.

**STEREOGRAPHY**, the art of drawing the forms and figures of the solids upon a plane.

**STEREOMETRY**, that part of geometry which teaches how to measure solid bodies, *i. e.* to find the solidity or solid content of bodies, as globes, cylinders, cubes, vessels, &c. See **GEOMETRY**.

**STEREOTOMY**, the art or act of cutting solids, or making

- king sections thereof, as walls or other members in the profiles of architecture.
- STERILITY**, the quality of a thing that is barren, in opposition to fertility.
- Nature has annexed sterility to all monstrous productions, that all the creation might not degenerate. Hence the sterility of mules, &c.
- STERLING**, a term frequent in British commerce. A pound, shilling, or penny sterling, signifies as much as a pound, shilling, or penny of lawful money of Great Britain, as settled by authority. See **MONEY**.
- STERN** of a ship, usually denotes all the hindermost part of her, but properly it is only the outmost part abaft.
- STERNBERG**, a town of Germany, in the circle of Upper Saxony and marquisate of Brandenburg, situated twenty-three miles north-east of Frankfort upon the Oder.
- STERNOHYOIDÆUS**, in anatomy. See **ANATOMY**, p. 223.
- STERNUM**, in anatomy. See **ANATOMY**, p. 175.
- STERNUTATORY**, a medicine proper to produce sneezing. Sternutatives are of two kinds, gentle and violent. Of the first kind are betony, sage, marjoram, tobacco, and the whole fashionable tribe of snuffs. Of the latter kind are euphorbium, white hellebore, pellitory, &c.
- STETIN**, a city and port-town of Germany, in the circle of Upper Saxony, capital of the duchy of Pomerania, situated on the west shore of the river Oder: E. long.  $14^{\circ} 50'$ , N. lat.  $53^{\circ} 30'$ .
- STEVENAGE**, a market-town of Hertfordshire, situated thirty miles north of London, and ten north-west of Hertford.
- STEW**, a small kind of fish-pond, the peculiar office of which is to maintain fish, and keep them in readiness for the daily use of the family &c.
- STEW**s, were also places anciently permitted in England to women of professed incontinency, for the proffer of their bodies to all comers. These were under particular rules and laws of discipline, appointed by the lord of the manor.
- STEWARD**, an officer appointed in another's stead or place, and always taken for a principal officer within his jurisdiction. Of these there are various kinds. The greatest officer under the crown is the lord high steward of England, an office that was anciently the inheritance of the earls of Leicester, till forfeited by Simon de Mountfort to king Henry III. But the power of this officer is so very great, that it has not been judged safe to trust it any longer in the hands of a subject, excepting only *pro hac vice*, occasionally; as, to officiate at a coronation, at the arraignment of a nobleman for high-treason or the like. During his office, the steward bears a white staff in his hand; and the trial &c. ended, he breaks the staff, and with it his commission expires. There is likewise a lord steward of the king's household, who is the chief officer of the king's court, has the care of the king's house, and authority over all the officers and servants of the household, except such as belong to the chapel, chamber, and stable.
- STEWART**, in Scots law. See **LAW**, Tit. iv. 5.
- STEWARTIA**, in botany, a genus of the monadelphia polyandria class. The calix is simple; the stigma is quinquesid; the berry has five lobes, and one seed. There is but one species, a native of Virginia.
- STEYNING**, a borough-town of Suffolk: situated forty miles south of London, and thirteen miles west of Lewes. It sends two members to parliament.
- STIBIUM**, or **ANTIMONY**. See **CHEMISTRY**, p. 87, 139.
- STICKLEBACK**, in ichthyology. See **GASTEROSTEUS**.
- STIGMA**, in botany. See **BOTANY**, p. 637.
- STIGMATA**, the apertures in different parts of the bodies of insects, communicating with the tracheæ, or air-vessels, and serving for the office of respiration.
- STIGMATA**, in antiquity, certain marks impressed on the left shoulders of the soldiers when lited.
- STIGMATIZING**, among the ancients, was inflicted upon slaves, as a punishment, but more frequently as a mark to know them by, in which case it was done by applying a red-hot iron marked with certain letters to their foreheads, till a fair impression was made, and then pouring ink into their furrows, that the inscription might be the more conspicuous.
- STILE**. See **STYLE**.
- STILES**, in carpentry, denote the upright pieces which go from the bottom to the top of any wainscot, or the like.
- STILLATITIOUS OILS**, such as are produced by distillation, in opposition to those got by infusion, expression, &c.
- STILL BOTTOMS**, in the distillery, a name given by the traders to what remains in the still after the working the wash into low wines. These bottoms are procured in the greatest quantity from the malt-wash, and are of so much value to the distiller in the fattening of hogs, &c. that he often finds them one of the most valuable articles of the business.
- STIMULATING**, a property in bodies, whereby they velleilate and cause vibrations and inflexions of the fibres of the nerves, and a greater derivation of nervous fluid into the parts affected. Stimulants produce pain, heat, redness, &c.
- STING**, an apparatus in the body of certain insects, in form of a little spear, serving them as a weapon of offence. See **ARIS**.
- STING**, in zoology. See **ALAUDA**.
- STIPA**, in botany, a genus of the triandria digynia class. The calix consists of two valves, containing one flower; the exterior valve of the corolla terminates in an awn; and it is jointed at the base. There are seven species, only one of them, *viz.* the pennata, or feather-grass, a native of Britain.
- STIPEND**, among the Romans, signified the same with tribute; and hence stipendiarii were the same with tributarii.
- STIPEND**, in Scots law. See **LAW**, Tit. v. 10, &c.
- STIPULATION**, in the civil law, the act of stipulating, that is, of treating and concluding terms and conditions to be inserted in a contract. Stipulations were anciently performed at Rome, with abundance of ceremonies; the first whereof was, that one party should interrogate, and the other answer, to give his consent, and oblige himself. By the ancient Roman law, no body could stipulate but for himself; but as the tabelliones were public servants, they were allowed to stipulate for their masters; and the notaries, succeeding the tabelliones, have inherited the same privilege.
- STIRIA DUCHY**, in Germany, is part of the circle of Austria,

**Austria**, bounded by the duchy of Austria on the north, by Hungary on the east, and by Carinthia and Carniola on the south-west.

**STIRLING**, a town of Scotland, capital of the county of Stirling: situated on the river Forth, thirty miles north-west of Edinburgh; defended by a castle and other works.

**STIRRUP**, in the manege, a rest, or support for the horseman's foot, serving to keep him firm in his seat, and to enable him to mount.

**STIRRUP of a ship**, a piece of timber put upon a ship's keel, when some of her keel happens to be beaten off, and they cannot come conveniently to put or fit in a new piece; then they patch in a piece of timber, and bind it on with an iron, which goes under the ship's keel, and comes up on each side of the ship, where it is nailed strongly with spikes; and this they call a stirrup.

**STIVES**, the ancient Thebes, in the province of Achaia, now Livadia, in European Turkey.

**STOCKHERN**, a town of Germany, in the circle of Westphalia, and bishopric of Liege: situated on the river Maes, twelve miles north of Maeltricht.

**STOCK**, in gardening, *ſc.* the stem or trunk of a tree.

**STOCKBRIDGE**, a borough-town of Hampshire, situated seven miles north-west of Winchester. It sends two members to parliament.

**STOCK-BROKER**. See **BROKER**, and the next article.

**STOCK-JOBBER**, the art or mystery of trafficking in the public stocks or funds. See **STOCKS**.

**STOCKHOLM**, the capital city of Sweden, situated on several small islands in the Meller Lake: E. long. 18°, N. lat. 59° 30', three hundred miles north-east of Copenhagen, nine hundred north-east of London, and four hundred west of Peterburgh. It is neither walled nor fortified, being sufficiently secured by nature, with little rocks and islands, which surround it, though it has a spacious harbour sufficient for the largest fleets. That part of the town which is properly the city, stands upon a little island that is not more than a mile and a half in circumference, but the suburbs on the adjacent island are much larger. The inhabitants are computed about thirty thousand.

**STOCKING**, that part of the cloathing of the leg and foot which screens them from the cold. *ſc.* Anciently, the only stockings in use were made of cloth, or of milled stuffs sewed together; but since the invention of knitting and weaving stockings of silk, wool, cotton, thread, &c. the use of cloth stockings is quite out of doors.

**STOCKPORT**, a market-town of Cheshire, situated thirty-four miles north-east of Chester.

**STOKTON**, a port-town of Durham, situated near the mouth of the river Tees, sixteen miles south of Durham.

**STOCKZOW**, a town of Bohemia, in the duchy of Silesia, situated on the river Vistula, thirty-seven miles south-east of Troppaw.

**STOCKS** or **PUBLIC FUNDS** in England. As there are few subjects of conversation more general than the value of stocks, and hardly any thing so little understood, we shall here give account of them in as clear and concise a manner as possible; presenting our readers with the rationale

of the stocks, and a short history of the several companies\*, describing the nature of their separate funds, the uses to which they are applied, and the various purposes they answer, both with respect to the government, the companies themselves, and the community in general.

In order to have a clear idea of the money-transactions of the several companies, it is necessary to know something of money in general, and the difference between that and the current specie. See the article **MONEY**.

Money is the standard of the value of all the necessaries and accommodations of life; and paper money is the representative of that standard to such a degree, as to supply its place, and to answer all the purposes of gold and silver coin. Nothing is necessary to make this representative of money supply the place of specie, but the credit of that office or company who delivers it: which credit consists in its always being ready to turn it into specie whenever required. This is exactly the case of the bank of England: the notes of this company are of the same value as the current coin, as they may be turned into it whenever the possessor pleases. From hence, as notes are a kind of money, the counterfeiting them is punished with death as well as coining.

The method of depositing money in the bank, and exchanging it for notes (though they bear no interest) is attended with many conveniencies; as they are not only safer than money in the hands of the owner himself, but as the notes are more portable and capable of a much more easy conveyance; since a bank note for a very large sum may be sent by the post, and, to prevent the designs of robbers, may, without damage, be cut in two, and sent at two several times. Or bills, called bank post-bills, may be had by application at the bank, which are particularly calculated to prevent losses by robberies, they being made payable to the order of the person who takes them out at a certain number of days after sight; which gives an opportunity to stop bills at the bank if they should be lost, and prevents their being so easily negotiated by strangers as common bank notes are: and whoever considers the hazard, the expence and trouble there would be in sending large sums of gold and silver to and from distant places, must also consider this as a very singular advantage. Beside which, another benefit attends them; for if they are destroyed by time, or other accidents, the bank will, on oath being made of such accident, and security being given, pay the money to the person who was in possession of them.

Bank notes differ from all kinds of stock in these three particulars. 1. They are always of the same value. 2. They are paid off without being transferred; and, 3. They bear no interest: while stocks are a share in a company's funds, bought without any condition of having the principal returned. India bonds indeed (by some persons, tho' erroneously, denominated stock) are to be excepted; they being made payable at six months notice, either on the side of the company or of the possessor.

By the word *stock* was originally meant a particular sum of money contributed to the establishing a fund to enable a company to carry on a certain trade, by means of which the person became a partner in that trade, and received a share of the profit made thereby, in proportion to the money employed.

\* Of these a general account only was given under the words **COMPANY**, and **BANK**, as it would be necessary to resume them in connection with the present article, the better to illustrate it.

ployed. But this term has been extended farther, though improperly, to signify any sum of money which has been lent to the government, on condition of receiving a certain interest till the money is repaid, and which makes a part of the national debt. As the security both of the government and of the public companies is esteemed preferable to that of any private person, as the stocks are negotiable and may be sold at any time, and as the interest is always punctually paid when due; so they are thereby enabled to borrow money on a lower interest than what could be obtained from lending it to private persons, where there must be always some danger of losing both principal and interest.

But as every capital stock or fund of a company is raised for a particular purpose, and limited by parliament to a certain sum, it necessarily follows, that when that fund is completed, no stock can be bought of the company; though shares already purchased may be transferred from one person to another. This being the case, there is frequently a great disproportion between the original value of the shares, and what is given for them when transferred: for if there are more buyers than sellers, a person who is indifferent about selling will not part with his share without a considerable profit to himself; and, on the contrary, if many are disposed to sell, and few inclined to buy, the value of such shares will naturally fall, in proportion to the impatience of those who want to turn their stock into specie.

These observations may serve to give our readers some idea of the nature of that unjustifiable and dishonest practice called *stock jobbing*, the mystery of which consists in nothing more than this: The persons concerned in that practice, who are denominated stock-jobbers, make contracts to buy or sell, at a certain distant time, a certain quantity of some particular stock, against which time they endeavour, according as their contract is, either to raise or lower such stock, by raising rumours and spreading fictitious stories in order to induce people either to sell out in a hurry, and consequently cheap, if they are to deliver stock, or to become unwilling to sell, and consequently to make it dearer, if they are to receive stock.

The persons who make these contracts are not in general possessed of any real stock; and when the time comes that they are to receive or deliver the quantity they have contracted for, they only pay such a sum of money as makes the difference between the price the stock was at when they made the contract; and the price it happens to be at when the contract is fulfilled; and it is no uncommon thing for persons not worth 100 l. to make contracts for the buying or selling 100,000 l. stock. In the language of Exchange Alley, the buyer in this case is called the Bull, and the seller the Bear.

Beside these, there are another set of men, who, though of a higher rank, may properly enough come under the same denomination. These are your great monied men, who are dealers in stock and contracters with the government whenever any new money is to be borrowed. These indeed are not fictitious, but real buyers and sellers of stock; but by raising false hopes, or creating groundless fears, by pretending to buy or sell large quantities of stock on a sudden, by using the fore-mentioned set of men as their instruments, and other like practices, are enabled to raise or lower the stocks one or two per cent. at pleasure.

However, the real value of one stock above another, on account of its being more profitable to the proprietors, or

any thing that will really, or only in imagination, affect the credit of a company, or endanger the government, by which that credit is secured, must naturally have a considerable effect on the stocks. Thus, with respect to the interest of the proprietors, a share in the stock of a trading company which produces 5 l. or 6 l. per cent. per ann. must be more valuable than an annuity with government security, that produces no more than 3 l. or 4 l. per cent. per annum; and consequently such stock must sell at a higher price than such an annuity. Though it must be observed, that a share in the stock of a trading company producing 5 l. or 6 l. per cent. per annum, will not fetch so much money at market as a government annuity producing the same sum; because the security of the company is not reckoned equal to that of the government, and the continuance of their paying so much per annum is more precarious, as their dividend is, or ought to be, always in proportion to the profits of their trade.

As the stocks of the East India, the bank, and South-Sea companies, are distinguished by different denominations, and are of a very different nature, we shall give a short history of each of them, together with an account of the different stocks each is possessed of; beginning with the East India company, as the first established.

#### *Of the East India Company.*

There is no trading company in Europe, the Dutch East India company excepted, which can be put in competition with this. It was first established in the latter end of the reign of queen Elizabeth; and its privileges have been enlarged, or confirmed, by almost every monarch since. Its shares, or subscriptions, were originally only 50 l. sterling; and its capital only 369,891 l. 5 s. but the directors having a considerable dividend to make in 1676, it was agreed to join the profits to the capital, by which the shares were doubled, and consequently each became of 100 l. value, and the capital 739,782 l. 10 s.; to which capital, if 963,639 l. the profits of the company to the year 1685, be added, the whole stock will be found to be 1,703,402 l.

However, this company having sustained several losses by the Dutch, and the subjects of the great Mogul, was in a declining way at the Revolution, when the war with France reduced it so low, that it appearing scarcely possibly to be supported, a new one was erected. The merchants forming the new East India company received their charter in 1698, having, in consideration of the grant thereof, lent the government two millions at 3 per cent. per annum; and pushing their trade with vigour, they soon carried on twice the business that was ever done by the old company. But after the two companies had subsisted a few years in a separate state, means were contrived to unite them; which was effected in 1702, when a new charter was granted them under the title of the United Company of Merchants trading to the East Indies.

To the two millions advanced by the new company, the united company in the 6th of queen Anne lent the government 1,200,000 l. which made their whole loan amount to 3,200,000 l. A further sum was also lent by the company in 1730, on a renewal of their charter, the interest of which is reduced to 3 per cent. and called the India 3 per cent. annuities.

As to India stock, it is of a quite different nature; for as that is not money put out to interest, but the trade  
stock

stock of the company; and the proprietors of the shares, instead of receiving a regular annuity, have a dividend of the profits arising from the company's trade; which, as it is more valuable, these shares generally sell at a price much above the original value.

As to the management of this united company, all persons without exception, natives and foreigners, men and women, are admitted members of it, and 500 l. in the stock of the company gives the owner a vote in the general court, and 2000 l. qualifies him to be chosen a director. The directors are 24 in number, including the chairman, and deputy chairman, who may be re-elected for four years successively. The chairman has a salary of 200 l. a year, and each of the directors 150 l. The meetings or courts of directors are to be held at least once a-week; but are commonly oftener, being summoned as occasion requires.

Out of the body of directors are chosen several committees, who have the peculiar inspection of certain branches of the company's business; as the committee of correspondence, a committee of buying, a committee of treasury, a house committee, a committee of warehouses, a committee of shipping, a committee of accounts, a committee of law-suits, and a committee to prevent the growth of private trade, &c. who have under them a secretary, cashier, clerks, warehouse-keepers, &c.

Other officers of the company are governors and factors abroad; some of whom have guards of soldiers, and live in all the state of sovereign princes.

#### *Of the Bank of England.*

The company of the bank was incorporated by parliament, in the 5th and 6th years of king William and queen Mary, by the name of the Governor and Company of the Bank of England, in consideration of the loan of 1,200,000 l. granted to the government, for which the subscribers received almost 8 per cent. By this charter, the company are not to borrow under their common seal, unless by act of parliament; they are not to trade, or suffer any person in trust for them to trade in any goods or merchandize; but they may deal in bills of exchange, in buying or selling bullion, and foreign gold and silver coin, &c.

By an act of parliament passed in the 8th and 9th year of king William III. they were empowered to enlarge their capital stock to 2,200,000 l. 10 s. It was then also enacted, that bank-stock should be a personal, and not a real estate; that no contract either in word or writing, for buying or selling bank-stock, should be good in law, unless registered in the books of the bank within seven days, and the stock transferred in 14 days; and that it should be felony, without benefit of clergy, to counterfeit the common seal of the bank, or any sealed bank-bill, or any bank-note, or to alter or erase such bills or notes.

By another act passed in the 7th of queen Anne, the company were empowered to augment their capital to 4,402,343 l. and they then advanced 400,000 l. more to the government, and in 1714 they advanced another loan of 2,500,000 l.

In the third year of the reign of king George I. the interest of their capital stock was reduced to 5 per cent. when the bank agreed to deliver up as many exchequer-bills as amounted to 2,000,000 l. and to accept an annuity of 200,000 l. and it was declared lawful for the bank to call

from their members, in proportion to their interests in the capital stock, such sums of money as in a general court should be found necessary. If any member should neglect to pay his share of the moneys so called for, at the time appointed by notice in the London Gazette, and fixed upon the Royal Exchange, it should be lawful for the bank not only to stop the dividend of such member, and to apply it toward payment of the money in question; but also to stop the transfers of the share of such defaulter, and to charge him with an interest of 5 l. per cent. per annum for the money so omitted to be paid: and if the principal and interest should be three months unpaid, the bank should then have power to sell so much of the stock belonging to the defaulter as would satisfy the same.

After this the bank reduced the interest of the 2,000,000 l. lent to the government from 5 to 4 per cent. and purchased several other annuities, which were afterward redeemed by the government, and the national debt due to the bank reduced to 1,600,000 l. But in 1742, the company engaged to supply the government with 1,600,000 l. at 3 per cent. which is now called the 3 per cent. annuities, so that the government was now indebted to the company 3,200,000 l. the one half carrying 4, and the other 3 per cent.

In the year 1746, the company agreed that the sum of 986,800 l. due to them in the exchequer-bills unsatisfied, on the duties for licences to sell spirituous liquors by retail, should be cancelled, and in lieu thereof to accept of an annuity of 39,442 l. the interest of that sum at 4 per cent. The company also agreed to advance the further sum of 1,000,000 l. into the exchequer, upon the credit of the duties arising by the malt and land tax, at 4 per cent. for exchequer-bills to be issued for that purpose; in consideration of which, the company were enabled to augment their capital with 986,800 l. the interest of which, as well as that of the other annuities, was reduced to 3 l. 10 s. per cent. till the 25th of December 1757, and from that time to carry only 3 per cent.

And in order to enable them to circulate the said exchequer bills, they established what is now called bank circulation: the nature of which not being well understood, we shall take the liberty to be a little more particular in its explanation than we have been with regard to the other stocks.

The company of the bank are obliged to keep cash sufficient to answer not only the common, but also any extraordinary demand that may be made upon them; and whatever money they have by them, over and above the sum supposed necessary for these purposes, they employ in what may be called the trade of the company; that is to say, in discounting bills of exchange, in buying of gold and silver, and in government securities, &c. But when the bank entered into the above mentioned contract, as they did not keep unemployed a larger sum of money than what they deemed necessary to answer their ordinary and extraordinary demands, they could not conveniently take out of their current cash so large a sum as a million, with which they were obliged to furnish the government, without either lessening that sum they employed in discounting, buying gold and silver, &c. (which would have been very disadvantageous to them,) or inventing some method that should answer all the purposes of keeping the million in cash. The method

which they chose, and which fully answers their end, was as follows.

They opened a subscription, which they renew annually, for a million of money; wherein the subscribers advance 10 per cent. and enter into a contract to pay the remainder, or any part thereof, whenever the bank shall call upon them, under the penalty of forfeiting the 10 per cent. so advanced; in consideration of which, the bank pays the subscribers 4 per cent. interest for the money paid in, and  $\frac{1}{2}$  per cent. for the whole sum they agree to furnish; and in case a call should be made upon them for the whole, or any part thereof the bank farther agrees to pay them at the rate of 5 per cent. per annum for such sum till they repay it, which they are under an obligation to do at the end of the year. By this means the bank obtains all the purposes of keeping a million of money by them; and though the subscribers, if no call is made upon them (which is in general the case,) receive  $6\frac{1}{2}$  per cent. for the money they advance, yet the company gains the sum of 23,500 l. per annum by the contract; as will appear by the following account.

The bank receives from the government for the advance of a million	£ 30,000
The bank pays to the subscribers who advance 100,000 l. and engage to pay (when called for) 900,000 l. more	6,500
<hr/>	<hr/>
The clear gain to the bank therefore is	23,500

This is the state of the case, provided the company should make no call on the subscribers; which they will be very unwilling to do, because it would not only lessen their profit, but affect the public credit in general.

Bank-stock may not improperly be called a trading stock, since with this they deal very largely in foreign gold and silver, in discounting bills of exchange, &c. Beside which, they are allowed by the government very considerable sums annually for the management of the annuities paid at their office. All which advantages render a share in their stock very valuable, though it is not equal in value to the East India stock. The company make dividends of the profits half-yearly, of which notice is publicly given when those who have occasion for their money may readily receive it; but private persons, if they judge convenient, are permitted to continue their funds, and to have their interest added to the principal.

This company is under the direction of a governor, deputy-governor, and 24 directors, who are annually elected by the general court, in the same manner as in the East India company. Thirteen, or more, compose a court of directors for managing the affairs of the company.

The officers of this company are very numerous.

#### *Of the South-Sea Company.*

During the long war with France in the reign of queen Anne, the payment of the sailors of the royal navy being neglected, and they receiving tickets instead of money, were frequently obliged by their necessities to sell these tickets to avaricious men at a discount of 40 l. and sometimes 50 l. per cent. By this and other means the debts of the nation unprovided for by parliament, and which amounted to 9,471,321 l. fell into the hands of these usurers. On which, Mr Harley, at that time chancellor of the exchequer, and afterward earl of Oxford, proposed a scheme to

allow the proprietors of these debts and deficiencies 6 l. per cent. per annum, and to incorporate them in order to their carrying on a trade to the South-Sea; and they were accordingly incorporated under the title of the Governor and Company of Merchants of Great Britain trading to the South-Seas and other parts of America, and for encouraging the Fishery, &c.

Though this company seemed formed for the sake of commerce, it is certain the ministry never thought seriously, during the course of the war, about making any settlements on the coast of South America, which was what flattered the expectations of the people; nor was it indeed ever carried into execution, or any trade ever undertaken by this company, except the Assiento, in pursuance of the treaty of Utrecht, for furnishing the Spaniards with negroes, of which this company was deprived by the late convention between the courts of Great Britain and Spain, soon after the treaty of Aix la Chapelle in 1748.

After this, some other sums were lent to the government in the reign of queen Anne at 6 per cent. In the third of George I. the interest of the whole was reduced to 5 per cent. and they advanced two millions more to the government at the same interest. By the statute of the 6th of George I. it was declared that this company might redeem all or any of the redeemable national debts, in consideration of which the company were empowered to augment their capital according to the sums they should discharge: and for enabling the company to raise such sums for purchasing annuities, exchanging for ready money new exchequer bills, carrying on their trade &c. the company might, by such means as they should think proper, raise such sums of money as in a general court of the company should be judged necessary. The company were also empowered to raise money on contracts, bills, bonds, or obligations under their common seal, on the credit of their capital stock. But if the sub-governor, deputy-governor, or other members of the company, should purchase lands or revenues of the crown upon account of the corporation, or lend money by loan or anticipation on any branch of the revenue, other than such part only on which a credit of loan was granted by parliament, such sub-governor, or other member of the company, should forfeit treble the value of the money so lent.

The fatal South-Sea scheme, transacted in the year 1720, was executed upon the last mentioned statute. The company had at first set out with good success, and the value of their stock for the first five years had risen faster than that of any other company; and his Majesty, after purchasing 10,000 l. stock, had condescended to be their governor. Things were in this situation, when, taking advantage of the above statute, the South Sea bubble was projected. The pretended design of which was to raise a fund for carrying on a trade to the South Seas, and purchasing annuities, &c. paid to the other companies: and proposals were printed and distributed, shewing the advantages of the design, and inviting persons into it. The sum necessary for carrying it on, together with the profits that were to arise from it, were divided into a certain number of shares, or subscriptions, to be purchased by persons disposed to adventure therein. And the better to carry on the deception, the directors engaged to make very large dividends, and actually declared, that every 100 l. original stock would yield 50 l. per annum, which occasioned so great a rise of their stock, that a share of 100 l. was sold for upward of 1000 l. This was

in the month of July; but before the end of September fell to 150 l. by which multitudes were ruined, and such a scene of distress occasioned as is scarcely to be conceived. But the consequences of this infamous scheme are too well known. We shall pass over all the other transactions of this company in the reign of king George I. as not material to our present purpose.

By a statute of the 6th of his late Majesty, it was enacted, that from and after the 24th of June 1733, the capital stock of this company, which amounted to 14,651,103 l. 8s. 1 d. and the shares of the respective proprietors, should be divided into four equal parts; three-fourths of which should be converted into a joint stock, attended with annuities, at the rate of 4 per cent. until redemption by parliament, and should be called The new South Sea annuities; and the other fourth part should remain in the company as a trading capital stock, attended with the residue of the annuities or funds payable at the exchequer to the company for their whole capital, till redemption; and attended with the same sums allowed for charges of management, and with all effects, profits of trade, debts, privileges and advantages belonging to the South Sea company. That the accountant of the company should twice every year, at Christmas and midsummer, or within one month after, state an account of the company's affairs, which should be laid before the next general court, in order to their declaring a dividend; and all dividends should be made out of the clear profits, and should not exceed what the company might reasonably divide without incurring any farther debt; provided that the company should not at any time divide more than 4 per cent. per annum, until their debts were discharged; and that the South Sea company, and their trading stock, should, exclusively from the new joint annuities, be liable to all the debts and incumbrances of the company; and that the company should cause to be kept within the city of London, an office and books, in which all transfers of the new annuities should be entered and signed by the party making such transfer, or his attorney; and the person to whom such transfer should be made, or his attorney, should underwrite his acceptance, and no other method of transferring the annuities should be good in law.

The annuities of this company, as well as the other, are now reduced to 3 l. per cent.

This company is under the direction of a governor, sub-governor, deputy governor, and 21 directors; but no person is qualified to be governor, his Majesty excepted, unless such governor has, in his own name and right, 5000 l. in the trading stock; the sub-governor is to have 4000 l. the deputy 3000 l. and a director 2000 l. in the same stock. In every general court, every member having in his own name and right 500 l. in trading stock, has one vote; if 2000 l. two votes; if 3000 l. three votes; and if 5000 l. four votes.

The East India Company, the Bank of England, and the South Sea Company, are the only incorporated bodies to which the government is indebted, except the Million Bank, whose capital is only one million, constituted to purchase the reversion of the long exchequer-orders.

The interest of all the debts owing by the government is now reduced to 3 per cent. excepting only the annuities for the years 1756 and 1758, the life-annuities, and the exchequer orders: but the South Sea company still continues to divide four per cent. on their present capital stock, which they are enabled to do from the profits they make on the

sums allowed to them for management of the annuities paid at their office, and from the interest of annuities which are not claimed by the proprietors.

As the prices of the different stocks are continually fluctuating above and below par; so when a person who is not acquainted with transactions of that nature, reads in the papers the prices of stocks, where bank-stock is marked perhaps 127 l. India ditto 134 a 134½. South Sea ditto 97½, &c. he is to understand that a 100 l. of those respective stocks sell at such a time for those several sums.

In comparing the prices of the different stocks one with another, it must be remembered, that the interest due on them from the time of the last payment, is taken into the current price; and the seller never receives any separate consideration for it, except in the case of India bonds, where the interest due is calculated to the day of the sale, and paid by the purchaser over and above the premium agreed for. But as the interest on the different stocks is paid at different times, this, if not rightly understood, would lead a person not well acquainted with them into considerable mistakes in his computation of their value; some always having a quarter's interest due on them more than others, which makes an appearance of a considerable difference in the price, when in reality there is none at all. Thus, for instance, old South Sea annuities sell at present for £. 85½ or £. 85 10s. while new South Sea annuities fetch only £. 84½, or £. 84 15s. though each of them produce the same annual sum of £. 3 per cent. but the old annuities have a quarter's interest more due on them than the new annuities, which amounts to 15s. the exact difference. There is, however, one or two causes that will always make one species of annuities sell somewhat lower than another, though of the same real value; one of which is, the annuities making but a small capital, and there not being for that reason so many people at all times ready to buy into it as into others where the quantity is larger; because it is apprehended, that whenever the government pays off the national debt, they will begin with that particular species of annuity the capital of which is the smallest.

A stock may likewise be affected by the court of chancery; for if that court should order the money which is under their direction to be laid out in any particular stock, that stock, by having more purchasers, will be raised to a higher price than any other of the like value.

By what has been said, the reader will perceive how much the credit and interest of the nation depends on the support of the public funds. While the annuities, and interest for money advanced, is there regularly paid, and the principal insured by both prince and people (a security not to be had in other nations) foreigners will lend us their property, and all Europe be interested in our welfare; the paper of the companies will be converted into money and merchandise, and Great Britain can never want cash to carry her schemes into execution.

In other nations, credit is founded on the word of the prince, if a monarchy; or that of the people, if a republic: but here, it is established on the interests of both prince and people; which is the strongest security: for however lovely and engaging honesty may be in other respects, interest in money-matters will always obtain confidence; because many people pay great regard to their interest, who have but little veneration for virtue.

**STOCKS**, among ship-carpenters, a frame of timber, and great posts, made ashore, to build pinnaces, ketches, boats, and such small craft, and sometimes small frigates. Hence we say, a ship is on the stocks, when she is a-building.

**STOCKS**, a wooden machine to put the legs of offenders in, for the securing of disorderly persons, and by way of punishment in divers cases, ordained by statute, &c.

**STOEBE**, in botany, a genus of the *syngenesia polygamia segregata* class. The receptacle is paleaceous; the pappus is feathered; and every floccule has a five-leaved calix. There is but one species, a native of Æthiopia.

**STOICS**, a sect of ancient philosophers, the followers of Zeno, thus called from the Greek *στοα*, which signifies a porch or portico, in regard Zeno used to teach under a portico or piazza.

To the praise of the Stoics in general, it must be confessed, that, less intent than other philosophers upon frivolous and often dangerous speculations, they devoted their studies to the clearing up of those great principles of morality which were the firmest supports of society; but the dryness and stiffness that prevailed in their writings, as well as in their manners, disgusted most of their readers, and abundantly lessened their utility. Zeno's chief followers, among the Greeks, were Lucippus, Cleanthes, Chrysippus, Diogenes Babylonius, Antipater, Panætius, Posidonius, and Epictetus; among the Romans, Cato, Varro, Cicero, Seneca, the emperor Antoninus, &c. The Stoics cultivated logic, physics, metaphysics, &c. but especially ethics. The principles of their dogmata, of the former kinds, are, that there are certain catalepsias or comprehensions, called innate ideas or principles, naturally found in the mind; that God is the seminal cause of the universe; and, with the Platonists, that the world is an animal, by reason of God's inhabiting and informing every part thereof; that nature is an artificial fire tending to generation; and that the world is at last to be destroyed by a conflagration. As for the morality of the Stoics, it was couched much in paradoxes; as, that a wife man is void of all passions, or perturbation of mind; that pain is no real evil, but that a wife man is happy in the midst of torture, is always the same, and is always joyful; that there is none else free; that none else ought to be esteemed king, magistrate, poet, or philosopher; that all wife men are great men; that they are the only friends or lovers; that nothing can happen to them beyond their expectations; that all virtues are insensibly connected together; that all good things are equal, and equally to be desired; that goodness admits of no increase or diminution. They own but one God, whom they however call by various names, as Fate, Jupiter, &c. by which they did not mean various things, but various powers and relations of the same thing. Providence they expressed under the name Fate, which Chrysippus defines to be a natural series or composition of things mutually following each other, by an immutable nexus or tie, fixed from all eternity. They held the immortality of the soul.

**STOKEGOMER**, a market-town of Somersetshire, situated twenty-two miles west of Wells.

**STOKESLY**, a market-town of Yorkshire, situated thirty miles north of York.

**STOLBERG**, a town of Germany, in the circle of Upper

Saxony, and territory of Thuringia, fifty-eight miles north-west of Leipzig.

**STOLE**, a sacerdotal ornament wore by the Romish parish-priests over their surplice, as a mark of superiority in their respective churches; and by other priests, over the alb, at celebrating of mass, in which case it goes a-cross the stomach; and by deacons, over the left shoulder, scarf-wise; when the priest reads the gospel for any one, he lays the bottom of his stole on his head. The stole is a broad swath, or slip of stuff, hanging from the neck to the feet, with three crosses thereon.

*Groom of the STOLE*, the eldest gentleman of his Majesty's bed chamber, whose office and honour it is to present and put on his majesty's first garment, or shirt, every morning, and to order the things in the chamber.

*Order of the STOLE*, an order of knights instituted by the kings of Arragon. Another military order, 'at Venice, is called the order of the golden stole; thus called from a golden stole, which those knights wore over their shoulder, reaching to the knee, both before and behind, a palm and a half broad. None are raised to this order but patricians, or noble Venetians.

**STOMACH**, in anatomy. See *ANATOMY*, p. 258.

**STOMACHIC**, in pharmacy, medicines that strengthen the stomach, and promote digestion, &c.

Stomachic corroboratives are such as strengthen the tone of the stomach and intestines; among which are carminatives, as the roots of galangals, red gentian, zedoary, pimpinella, calamus, aromaticus, and arum. Of barks and rinds, those of canella alba, saffrafas, citrons, Seville and China oranges, &c. Of spices, pepper, ginger, cloves, cinnamon, cardamums, and mace.

**STONES**, in natural history, are defined to be essentially compound fossils, not inflammable, nor soluble in water or oil, nor at all ductile; found in continued strata, or beds, of great extent; formed either of a congeries of small particles, in some degree resembling sand, and lodged in a smoother cementitious matter; or else of this cementitious matter, and the grit or sand-like particles, running together into one smooth mass; or, finally, of granules cohering by contact, without any cementitious matter among them; or composed of crystal or spar, usually debased by earth, and often mixed with talc and other extraneous particles.

Of this class of fossils there are three orders; and under these, eight genera.

The first order comprehends all the coarse, harsh, and rough stones, of a lax texture, and composed of a visible grit, resembling sand in form, and usually immersed in a cementitious matter, and of little natural brightness; scarce capable of any polish, and naturally mouldering away in form of powder from the tools of the workmen. The genera of this order are two, *viz.* the amochista and psaduria; the former of which constitute our grey and rough slates; and the latter comprehends most of the stones used in building, particularly Portland stone.

The second order consists of stones moderately fine, of a more compact and even texture, scarce distinguishable construction, and affording no sand-like particles to the view; of some natural brightness, capable of a tolerable polish, and flying off from the tools of the workmen in form of small chips. Under this order are comprehended the *sympexia* and *stegania*.

The third order consists of stones of a very fine substance and elegant structure, naturally of a great brightness, and capable of an elegant polish; composed of granules of various shapes and sizes; but usually flattish, sometimes more, sometimes less distinct; and, in some species, running together into uniform masses, but never lodged in any cementitious substance. Of this order are the marbles, alabasters, porphyries, and granites.

**STONE** in the bladder. See **MEDICINE**, and **SURGERY**. **STONE** also denotes a certain quantity or weight of some commodities.

A stone of beef, at London, is the quantity of eight pounds; in Hertfordshire, twelve pounds; in Scotland, sixteen pounds.

**STONE CHATTER**, in ornithology. See **MOTACILLA**.

**STONEHENGE**, in antiquity, a famed pile or monument of huge stones on Salisbury plain, six miles distant from that city.

It consists of the remains of four ranks of rough stones, ranged one within another, some of them, especially in the outermost and third rank, twenty feet high, and seven broad; sustaining others laid across their heads, and fastened by mortises; so that the whole must have anciently hung together.

Antiquaries are now pretty well agreed that it was a British temple; and Dr Langwith thinks it might easily be made probable, at least, that it was dedicated to the sun and moon. Inigo Jones has given a fine scheme of the work, and strives hard to persuade the world, that it was Roman: but Dr Langwith, who took his measures on the spot, assures us he could by no means reconcile them with that scheme.

**STONEY-STRATFORD**, a market-town of Buckinghamshire, fourteen miles north of Aylesbury.

**STOOL**, in medicine, an evacuation or discharge of the feces, &c. by the anus.

**STOPPER**, in a ship, a piece of cable-laid rope, having a wale-knot at one end, with a laniard fastened to it; and the other end is spliced round a thimble in the ring-bolts upon deck, and at the bits: its use is to stop the cable, that it may not run out too fast; in order to which, they make turns with the laniard about the cable, and the wale-knot stops it, so that it cannot slip away faster than is necessary.

**STORAX**, or **STYRAX**, in natural history, a dry and solid resin, of a reddish colour, and a peculiarly fragrant smell; of which there are two kinds, the styrax calamita, or styrax in tears, and the styrax vulgaris; whereof the former is by far the purer and finer kind, imported in small loose granules, or else in large masses composed of such granules: it anciently used to be packed up in reeds, for the more secure carriage; whence the name. The common storax is likewise a fine and pure resin, though less so than the former; and is brought to us in large lumps, not formed of granules, but of one uniform consistence.

These are the two genuine kinds of storax; but neither of them is that met with in our shops, which is a kind of saw-dust connected into lumps, by just so much of the storax resin as will make the other matters hang together. This is what our apothecaries use, under the name of storax; but it is advisable to strain carefully the pure resin from the filth, and use no part of the latter.

The two genuine kinds of storax, which ought always

to be used where they can be had, differ only in this; that the granulated storax flows naturally from the styrax tree, and the common kind is obtained from the same tree by incision.

Storax is brought to us from Syria, and the East-Indies; and ought to be chosen pure, very fragrant, and of an acid taste. It is much recommended as a detergent and balsamic, in disorders of the breast: it is also esteemed a cordial, and is recommended in vertigoes and other disorders of the head and nerves.

**Liquid STORAX**, in pharmacy, is a drug very different from the resin above described; being a resinous juice, of the consistence of venice-turpentine, or thicker: it is, when clean, pellucid, of a brownish colour, with a cast sometimes of reddish, and sometimes of greyish in it. Its smell is somewhat like that of common storax, only much stronger, and even disagreeable: its taste is acrid, aromatic, and somewhat bitterish; and it is oily, or unctuous. It should be chosen thin, pellucid, of a clean brown colour, and of a very strong smell.

**STORGE**, a greek term, frequently used for the parental instinct, or natural affection, which almost all animals bear their young; whereby they are most powerfully moved to defend them from dangers, and procure for them suitable nourishment.

**STORK**, in ornithology. See **ARDEA**.

**STORM BIRD**. See **PROCELLARIA**.

**STORMAR**, the south division of Holstein, whereof Hamburgh is the chief town.

**STORTFORD**, a market-town of Hertfordshire, thirty miles north of London.

**STOVES**, in gardening, are buildings erected for the preservation of tender exotic plants, which, without that assistance, will not bear the cold of our winter, because they require an artificial warmth.

Stoves are of two kinds, distinguished by the names of the dry and the bark-stoves.

The dry stove has the flues, in which the smoke is carried, either laid under the pavement of the floor, or erected in the back part of the house over each other, and returned six or eight times all along the stove. In these stoves the plants are placed on scaffolds, and benches of boards, raised above one another; and the plants principally preserved in these are the aloes, ceruses, euphorbiums, tithymals, and other succulent plants, which are impatient of moisture in winter, and therefore are not to be kept among trees, or herbaceous plants, which perspire freely.

The bark-stoves are made with a large pit, nearly of the length of the house, which is three feet deep, and six or seven feet wide. This pit is to be filled with fresh tanner's bark to make a hot-bed, and in this the pots containing the tender plants are to be plunged.

**STOURBRIDGE**, a market-town, nineteen miles north of Worcester.

**STOUTH-RIEF**, in Scots law. See **LAW**, Tit. xxxiii. 30.

**STOW**, a market-town, twenty miles east of Gloucester.

**STOWAGE**, in the sea-language, the placing goods orderly in the hold of a ship, viz. the heaviest next the ballast, &c.

**STOWEY**, a market-town of Somersetshire, eighteen miles west of Wells.

**STOW-MARKET**, a town of Suffolk, ten miles east of Bury.

- STRABISMUS**, *SQUINTING*, a distortion of the eyes, whereby their pupils are turned from, instead of being directed towards, objects at which they look : sometimes only one eye, but more frequently both are thus affected. See *MEDICINE*, p. 155.
- STRAIN**, in surgery, a violent extension of the sinews, or tendons, of some muscle.
- STRAIT**, is a narrow passage out of one sea into another, as those of Gibraltar and Magellan.
- STRAKES**, in the sea-language, signify the uniform ranges of planks on the bottom, decks, and sides of ships ; and the garboard-strake is that next the keel.
- STRALSUND**, a strong city and port-town of Germany, in the circle of Upper Saxony and duchy of Pomerania, subject to Sweden: E. long.  $13^{\circ} 22'$ , and N. lat.  $54^{\circ} 23'$ .
- STRAND**, signifies any shore of the sea, or bank of a great river : hence an immunity from paying customs on goods or vessels, was anciently expressed by strand and stream.
- STRANDED**, among seamen, is said of a ship that is driven ashore by a tempest, or runs on ground through ill steering, and so perishes.
- STRANGFORD**, a town of Ireland, that gives name to a loch and bay in the county of Down and province of Ulster, situated nine miles east of Down.
- STRANGURY**, in medicine a suppression of urine. See *MEDICINE*, p. 160.
- STRANRAER**, a parliament-town of Scotland, situated in the shire of Galloway, on a bay of the frith of Clyde.
- STRAPS** of a saddle, are strong leather-thongs, nailed to the bows of a saddle, in order to make the girths, &c. fast.
- STRAPADO**, a kind of military punishment, wherein the criminal is hoisted up by a rope, and let down, so that, by the weight of his body in the fall, his arms are dislocated.
- STRASBURG**, a free imperial city of Germany, capital of the landgraviate of Alsace, situated near the western bank of the Rhine, in E. long.  $7^{\circ} 35'$ , and N. lat.  $48^{\circ} 38'$ .
- STRATA**, in natural history, the several beds or layers of different matters, whereof the body of the earth is composed.
- The strata include all the layers of earths, minerals, metals, stones, &c. lying under the upper tegument, or stratum, the turf or mould.
- The time when these several strata were laid, was doubtless at the creation ; unless, with some great naturalists, as Steno, Dr. Woodward, &c. we suppose the globe of the earth to have been dissolved by the deluge.
- STRATAGEM**, in the art of war, any device for the deceiving and surprising an enemy.
- STRATEGUS**, in Grecian antiquity, an annual officer among the Athenians, whereof there were two chosen, to command the troops of the state.
- STRAFORD**, a populous market-town of Warwickshire, situated on the river Avon, six miles south of Warwick ; remarkable for being the birth place of the inimitable Shakespeare, and lately for the Jubilee held there in honour of his memory, September 1769.
- STRATHNAVER**, a subdivision or district of the county of Sutherland, in Scotland, having the Caledonian ocean on the north and west.
- STRATIFICATION**, in chemistry, the ranging any thing to be calcined in several layers or strata one above another.
- STRATIOTES**, in botany, a genus of the polyandria hexagynia class. The spathe consists of two leaves, and the perianthium of three segments ; the corolla has three petals, and the berry has six cells. There are two species, one of them, *viz.* the aloides, water-aloe, or fresh-water folder, a native of Britain.
- STRAFFON**, a market-town of Cornwall, situated a little south of the Britol channel, fourteen miles north-west of Launceston.
- STRAWBERRY**, in botany. See *FRAGARIA*.
- STRAWBERRY TREE**, in botany. See *ARBURUS*.
- STRENGTH**, in physiology, the same with force or power.
- STRENGTHENERS**, in pharmacy, medicines that add to the bulk and firmness of the solids : and such are all absorbent, agglutinant, and astringent medicines.
- STRIAE**, in the ancient architecture, the same with the flutings of columns. See *FLUTES*.
- STRIATED LEAF**, among botanists, one that has a number of longitudinal furrows on its surface.
- STRIGONENSIS TERRA**, *earth of Strigonium*, in the materia medica, a red earth, of the bole kind, found about the gold-mines at Strigonium in Hungary, and used in some places as an astringent and sudorific.
- It is but of a coarse and impure texture, and lighter than most of the boles in colour ; it is of a strong, but dull red, and is of a tolerably smooth surface ; it is apt to crumble to pieces between the fingers, and stains the skin in handling ; it melts freely in the mouth, and has a remarkable smoothness, but very little astringency in its taste, and leaves a sensible grittiness between the teeth ; it is sometimes veined and spotted with small molecules of an earth, like the whitish variegations of the red French bole.
- STRIKE**, a measure of capacity, containing four bushels.
- STRIKE**, among seamen, is a word variously used : when a ship, in a fight, or on meeting with a ship of war, sets down or lowers her top-sails, at least half-mast high, they say she strikes, meaning the yields, or submits, or pays respect to the ship of war. Also, when a ship touches ground, in shoal-water, they say she strikes. And when a top-mast is to be taken down, the word of command is, Strike the top-mast, &c.
- STRIX**, in ornithology, a genus belonging to the order of accipitres. The bill is hooked, but has no cere or wax ; the nostrils are covered with fetaceous feathers ; the head is very large, as are also the ears and eyes ; and the tongue is bith. There are twelve species, comprehending all the owl-kind. They are night-birds, and feed upon mice, bats, &c.
- STROBILUS**, among botanists. See *BOTANY*, p. 637.
- STROMATEUS**, in ichthyology, a genus belonging to the order of apodes. The head is compressed, the teeth are in the jaws and palate ; the body is oval, and slimy ; and the tail is forked. There are two species.
- STROMBOLI**, one of the Lipari islands, fifty miles north of Messina.
- STRONGOLI**, a town of the Hither Calabria, in the kingdom of Naples, situated on the gulph of Taranto.
- STROPHE**, in ancient poetry, a certain number of verses, including a perfect sense, and making the first part of an ode.
- STROUD**, a market-town, nine miles south of Gloucester.

**STRUMÆ**, scrophulous tumours arising on the neck and thro' at, constituting what is commonly called the king's evil. See **MEDICINE**, p. 137, &c.

**STRUTHIO**, the **OSTRICH**, in ornithology, a genus belonging to the order of gallæ. The bill is somewhat conical; the nostrils are oval; the wings are short, and not fit for flying; and the feet are of the running kind. There are three species. The camelus, or common ostrich, is a native of Syria, Arabia, Lybia, and Africa. This is the largest of all birds; it runs swifter than any animal; it lays about 50 eggs in the sand, and sits upon them only during the night, the heat of the sun being sufficient during the day.

**STRYCHNOS**, in botany, a genus of the pentandria monogynia class. The corolla consists of five segments; and the berry has but one cell. There are two species, both natives of Britain.

**STUCCO**, in building, a composition of white marble, pulverized and mixed with plaster of lime; and the whole being sifted and wrought up with water, is to be used like common plaster: this is what Pliny means by marmoratum opus, and albarium opus.

**STUFF**, in commerce, a general name for all kinds of fabrics of gold, silver, silk, wool, hair, cotton, or thread, manufactured on the loom; of which number are velvets, brocades, mohairs, fattins, taffeties, cloths, serges, &c.

**STUM**, in the wine-trade, denotes the unfermented juice of the grape, after it has been several times racked off and separated from its sediment. The casks are, for this purpose, well matched, or fungated with brimstone every time, to prevent the liquor from fermenting, as it would otherwise readily do, and become wine.

**STUPOR**, a numbness in any part of the body, whether occasioned by ligatures obstructing the blood's motion, by the palsy, or the like.

**STUPHA**, or **STUPE**, in medicine, is a piece of cloth dipped in some proper liquor, and applied to an affected part, by way of fomentation or epithem.

**STURGEON**. See **ACCIPENSER**.

**STURMINSTER**, a market-town, eighteen miles north of Dorchester.

**STURNUS**, the **STARLING**, in ornithology, a genus belonging to the order of passerines. The beak is tubulated, depressed, and somewhat blunt; the superior mandible is entire, and somewhat open at the edges; the nostrils are marginated above; and the tongue is sharp and emarginated. There are five species, distinguished by their colour.

**STYLE**, a word of various significations, originally deduced from **STYLOS**, a kind of bodkin, wherewith the ancients wrote on plates of lead, or on wax, &c. and which is still used to write on ivory-leaves, and paper prepared for that purpose, &c.

**STYLE**, in dialling, denotes the gnomon or cock of a dial, raised on the plane thereof, to project a shadow. See **DIALLING**.

**STYLE**, in botany. See **BOTANY**, p. 637.

**STYLE**, in matters of language, a particular manner of expressing one's thoughts agreeably to the rules of syntax; or, as F. Buffier more accurately defines it, the manner wherein the words, constructed according to the laws of syntax, are arranged among themselves, suitably to the genus of the language. See **COMPOSITION**.

**STYLE**, in jurisprudence, the particular form or manner of proceeding in each court of jurisdiction, agreeable to the rules and orders established therein: thus we say the style of the court of Rome, of Chancery, of Parliament, of the Privy council, &c.

**Old-STYLE**, the Julian manner of computing time, as the **New-STYLE** is the Gregorian method of computation. See **ASTRONOMY**, p. 490.

**STYLET**, a small dangerous kind of poignard, which may be concealed in the hand, chiefly used in treacherous assassinations. The blade is usually triangular, and so slender that the wound it makes is almost imperceptible.

**STYLITES**, an appellation given to a kind of solitaries, who spend their lives seated on the tops of columns, to be, as they imagine, the better disposed for meditation, &c. Of these we find several mentioned in ancient writers, and even as low as the eleventh century. The founder of the order was St. Simon Stylites, a famous anchorite in the fifth century, who took up his abode on a column six cubits high; then on a second, of twelve cubits; a third, of twenty-two; and, at last, on another of thirty-six. The extremity of these columns were only three feet in diameter, with a kind of rail or ledge about it that reached almost to the girdle, somewhat resembling a pulpit. There was no lying down in it. The faquirs, or devout people of the east, imitate this extraordinary kind of life even to this day.

**STYLOGLOSSUS**, in anatomy. See **ANATOMY**, p. 304.

**STYLOHYOIDÆUS**, in anatomy. See **ANATOMY**, p. 304.

**STYLOIDES**, in anatomy. See **ANATOMY**, p. 155.

**STYLOPHARYNGÆUS**, in anatomy. See **ANATOMY**, p. 304.

**STYPTIC**, in pharmacy, medicines which by their astringent qualities stop hemorrhages.

**STYRAX**, in botany, a genus of the dodecandria monogynia class. The calix consists of five teeth, and the corolla of one funnel-shaped petal; and the dropa has one cell, containing two seeds. There is but one species, a native of Syria. See **STORAX**.

**SUBALTERN**, a subordinate officer, or one who discharges his post under the command, and subject to the direction of another: such are lieutenants, sub-lieutenants, coronets and ensigns, who serve under the captain.

**SUBBUTEO**, in ornithology. See **FALCO**.

**SUBCLAVIAN**, in anatomy, is applied to any thing under the arm-pit or shoulder, whether artery, nerve, vein, or muscle.

**SUBCOSTAL MUSCLES**. See **ANATOMY**, p. 215.

**SUBER**, in botany. See **QUERCUS**.

**SUBJECT**, a person under the rule and dominion of a sovereign prince or state.

**SUBJECT**, is also used for the matter of an art or science, or that which it considers, or whereon it is employed: thus the human body is the subject of medicine.

**SUBJUNCTIVE** in grammar. See **GRAMMAR**.

**SUBLIMATE**, a chemical preparation, the basis whereof is mercury or quick-silver. See **CHEMISTRY**, p. 128.

**SUBLIMATION**, the condensing and collecting in a solid form, by means of vessels aptly constructed, the fumes of bodies raised from them by the application of a proper heat. See **CHEMISTRY**, p. 138.

**SUBLINGUAL GLANDS**. See **ANATOMY**, p. 207.

**SUBMIS-**

**SUBMISSION**, in Scots law. See *LAW*, Tit. xxxii. 15.

**SUBORDINATION**, a relative term, expressing the degree of inferiority between one thing and another.

**SUBORNATION OF PERJURY**, in Scots law. See *LAW*, Tit. xxxiii. 35.

**SUBPOENA**, in law, a writ whereby all common persons, or those under the degree of peerage, may be called into chancery, in any case where the law cannot afford a remedy.

**SUBREPTION**, the act of obtaining a favour from a superior, by surprize or a false representation.

**SUBREPTITIOUS**, a term applied to a letter, licence, patent, or other act, fraudulently obtained of a superior, by concealing some truth, which, had it been known, would have prevented the concession or grant.

**SUBROGATION**, in the civil law, the act of substituting a person in the place, and entitling him to the rights of another.

**SUBSCAPULARIS**, in anatomy. See *ANATOMY*, p. 196.

**SUBSCRIPTION**, in general, signifies the signature put at the bottom of a letter, writing, or instrument.

**SUBSEQUENT**, something that comes after another, particularly with regard to the order of time.

**SUBSIDY**, in law, signifies an aid or tax granted to the king, by parliament, for the necessary occasions of the kingdom; and is to be levied on every subject of ability, according to the rate or value of his lands or goods: but this word, in some of our statutes, is confounded with that of customs.

**SUBSISTENCE**, in the military art, is the money paid to the soldiers weekly, not amounting to their full pay; because their cloaths, accoutrements, tents, bread, &c. are to be paid.

**SUBSTANCE**, something that we conceive to subsist of itself, independently of any created being, or any particular mode or accident. See *METAPHYSICS*.

**SUBSTANTIAL**, in the schools, something belonging to the nature of substance.

**SUBSTANTIVE**, in grammar. See *GRAMMAR*.

**SUBSTITUTE**, a person appointed to officiate for another, in case of absence or other legal impediment.

**SUBSTITUTION**, in the civil-law, a disposition of a testament, whereby the testator substitutes one heir for another, who has only the usufruit, and not the property of the thing left him.

**SUBTRACTION**, in arithmetick. See *ARITHMETICK*, p. 370.

**SUBTRACTION**, in algebra. See *ALGEBRA*, p. 81.

**SUBTENSE**, in geometry, the same with the chord of an arch. See *CHORD*.

**SUBTERRANEAN**, whatever is under-ground: thus, naturalists speak of subterranean fires, damps, &c.

**SUBTILE**, in physics, an appellation given to whatever is extremely small, fine, and delicate; such as the animal spirits, the effluvia of odorous bodies, &c. are supposed to be.

**SUBULARIA**, in botany, a genus of the tetradynamia siliculosa class. The pod is entire, oval, with oval concave valves; and the stylus is shorter than the pod. There is but one species, viz. the aquatica, or awl-wort, a native of Britain.

**SUBULATED**, something in the shape of an awl.

**SUCCEDANEUM**, in pharmacy, denotes a drug substi-

tuted in the place of another, in medical composition.

**SUCCESSION**, in philosophy, an idea which we get by reflecting on that train of ideas constantly following one another in our minds when awake.

**SUCCESSION**, in Scots law. See *LAW*, Tit. xxvii. 1, &c. xxviii. 1, &c.

**SUCCESSOR**, in law, one that succeeds, or comes in the place of another.

**SUCCINUM**, in natural history. See *AMBER*.

**SUCCISA**, in botany. See *SCABIOSA*.

**SUCCORY**, in botany. See *CICHORIUM*.

**SUCCUBUS**, a term used by some imaginary writers, for a demon who assumes the shape of a woman, and as such lies with a man; in which sense, it stands opposed to incubus, which was a demon in form of a man, that they supposed to lie with a woman.

But the truth is, the succubus is only a species of the incubus, or night-mare. See *MEDICINE*, p. 157.

**SUCCULA**, in mechanics, a bare axis, or cylinder, with flaves to move it round; but without any tympanum or peritrochium.

**SUCCULENT PLANTS**, those whose leaves are thick, and abound with juice.

**SUCHUEN**, a province of China, bounded by that of Xensi on the north, by Honam and Huquam on the east, by Quecheu and Yunam on the south. and by the mountains of India on the west: its chief town is Chingtu.

**SUCKERS**, in gardening, the same with off-sets. See *OFF-SETS*.

**SUCTION**, the act of sucking or drawing up a fluid, as air, water, milk, or the like, by means of the mouth and lungs. See *PNEUMATICS*, and *HYDROSTATICS*.

**SUDATORY**, a name given by the ancient Romans to their hot or sweating-rooms; sometimes also called laconica.

**SUDBURY**, a borough-town of Suffolk, thirteen miles south of Bury. It sends two members to parliament.

**SUDORIFIC**, an appellation given to any medicine that causes or promotes sweat.

**SUEZ**, a port-town of Egypt, situated at the bottom of the Red-sea, seventy miles east of Cairo: it is from this town that the isthmus of Suez, which joins Africa to Asia, takes its name.

**SUFFOCATION**, in medicine, the privation of respiration, or breathing; which is sometimes occasioned by a congestion of blood in the lungs, so as to prevent the ingress of the air.

**SUFFOLK**, a county of England, bounded by Norfolk on the north, by the German-sea on the east, by Essex, from which it is separated by the river Maningtree, on the south, and by Cambridgeshire on the west; being sixty two miles long, and twenty-eight broad.

**SUFFRAGAN**, an appellation given to simple bishops with respect to archbishops, on whom they depend, and to whom appeals lie from the bishops courts.

**SUFFRAGE**, denotes a vote given in an assembly, where something is deliberated on, or where a person is elected to an office or benefice.

**SUFFRUTEX**, among botanists, denotes an under-shrub, or the lowest kind of woody plants, as lavender, rue, &c.

**SUGAR**, in natural history, is properly the essential salt of the sugar-cane, as tartar is of the grape. See *CHEMISTRY*, p. 161. and *SACCHARUM*.

This plant rises to eight, nine, or more feet high; the stalk,

stalk, or cane, being round, jointed, and two or three inches in diameter at the bottom: the joints are three or four inches asunder, and in a rich soil more: the leaves are long and narrow, and of a yellowish green colour; as is also the stalk itself, the top of which is ornamented with a panicle, or cluster of arundinaceous flowers, two or three feet in length.

They propagate the sugar-cane, by planting cuttings of it in the ground in furrows, dug parallel for that purpose; the cuttings are laid level and even, and are covered up with earth; they soon shoot out new plants from their knots or joints: the ground is to be kept clear, at times, from weeds; and the canes grow so quick, that in eight, ten, or twelve months, they are fit to cut for making of sugar from them. The manner of doing it is thus: They cut off the reeds at one of the joints near the roots; they are then cleared of the leaves, and tied up in bundles, and sent to the mills, which are worked either by water or horses.

The sugar-mill is composed of three rollers of an equal size, and all armed with iron-plates, where the canes are to pass between them; only the middle roller is much higher than the rest, to give the larger sweep to the two poles to which the horses are yoked. This great roller in the middle is furnished with a cog full of teeth, which catch the notches in the two side-rollers, and force them about to bruise the canes, which pass quite round the great roller, and come out dry and squeezed from all their juice; which runs into a vessel or bark under the mill, and is thence conveyed through a narrow spout into the first boiler.

After the juice is let out of the first vessel, it is received into another; in which it is boiled more briskly, and skimmed from time to time with a large kind of spoon, pierced with holes to let the liquor through, while it retains the scum and foulness separated from it in boiling: towards the end of this boiling, they throw into it a strong lixivium of wood-ashes, with some quick-lime among it: this greatly promotes the separation of the foulness that yet remains amongst it; and, after it has boiled some time with this addition, they strain it off. The scum left in the cloths make a kind of wine, when fermented properly with water. The strained liquor, which is now tolerably clean, is let into a third boiler, in which it is boiled down to the consistence of sugar over a very brisk fire, the people who attend it continually stirring and skimming it.

Great caution is to be used that the boiling matter does not rise over the sides of the vessel, which would be of very dangerous consequence: they prevent this by taking up quantities of the boiling matter with a ladle, lifting it up high, and letting it run in again, and by now and then adding a small piece of butter, or fat of some kind, which takes down the bubbling almost instantaneously. They are very careful that no lemon-juice, or any other acid of that kind, comes near the vessels, a very small admixture of that being sufficient to keep the matter from granulating. When the liquor is boiled enough, which is known by its concreting on throwing a spoonful of it up into the air, it is then let out into a fourth vessel, under which there is a very gentle fire, only kept up that it may have leisure to granulate; when it has begun to granulate, it is let out of this last boiler into a kind of

conic earthen vessels, open at both ends; the widest aperture is placed upwards, and the smaller end downwards, its aperture being stopped with a wooden plug. It is left in these vessels twenty-four hours to concrete: after this they are removed into sugar-houses, and are there arranged in regular order, with a vessel of earthen-ware under each; the plug is then taken out of the bottom aperture of each, and they are left in this condition for about forty days, that all the thick liquor, or melasses, may run from them: after they have stood thus long to drain of themselves, a quantity of clay is diluted, with water, into a thin paste; and this is poured on the top of every parcel of sugar in the vessels, so as to cover it two or three inches deep. This water, by degrees, all leaves the clay, and penetrating into the mass of sugar, runs through it, and carries off yet more of this foul thick liquid with it, into the vessels placed underneath to receive it.

When the clay is quite dry, it is taken off, and the first preparation of the sugar is now finished; they shake it out of the vessels, and, cutting it into lumps, which are of a dirty, brownish, or greyish colour, they put it up in hogheads, and other casks, under the name of grey or brown sugar. The sugar, in this state, ought to be dry, not unctuous, and to have no taste of burning. The liquor which has run from the sugar in standing, is boiled to a consistence, and sold under the name of melasses, or treacle; this affords, by fermentation, a very clean and good spirit.

This coarse sugar is afterwards refined to various degrees of purity by new solutions, and is sold at different prices, and under different names, according to the degree of purity it is brought to. Our sugar refiners first dissolve it in water, then clarify the solution by boiling with whites of eggs and despumation; and after due evaporation pour it into moulds; where the fluid part being drained off, and the sugar concreted, its surface is covered with moist clay, as before. The sugar thus once refined, by repetition of the process becomes the double-refined sugar of the shops. The candy-sugar, or that in crystals, is prepared by boiling down solutions of sugar to a certain pitch, and then removing them into a hot room, with sticks placed across the vessel for the sugar to shoot upon: and these crystals prove of a white or brown colour, according as the sugar used in the process was pure or impure.

**SUGILLATION**, in medicine, an extravasation of blood in the coats of the eye, which at first appears of a reddish colour, and afterwards livid or black. If the disorder is great, bleeding and purging are proper, as are discutients.

**SUIT**, in law, is used in different senses; as, 1. For an action, whether personal or real. 2. Suit of court, or suit-service, which is an attendance the tenant owes to his lord's court. 3. Suit-covenant, where a person has covenanted to do service in the court of the lord. 4. Suit-custom, which is where one and his ancestors have owed suit time out of mind. 5. It is used for a petition to the king, or any person of dignity; where a lord distrains his tenant for suit, and none is due; in this case, the party may have an attachment against him to appear in the king's court. 6. Suit of the king's peace, is an action brought against a person for breach of the king's peace; as in the case of treasons, felonies, or trespasses.

**SULPHUR.** See CHEMISTRY, p. 72, 118.

**SULTAN,** a title of honour, given to the emperor of the Turks. The wife of a sultan is called sultana, and the favourite one hhafeke-sultana, *i. e.* the private sultana.

**SUM,** signifies the quantity that arises from the addition of two or more magnitudes, numbers, or quantities together. See ARITHMETICK.

**SUMACH,** in botany. See RHUS.

**SUMATRA** an island in the East-indian ocean, situated between 93° and 104° E. long. and between 5° 30' N. lat. and 5° 30' S. lat. extending from north-west to south-east, nine hundred miles long, and from one hundred to one hundred and fifty broad.

**SUMMARY,** in matters of literature. See ABRIDGEMENT.

**SUMMER,** one of the seasons of the year, commencing in their northern regions on the day the sun enters Cancer, and ending when he quits Virgo. See ASTRONOMY, p. 554.

**SUMMIT,** the top or vertex of any body, or figure; as of a triangle, cone, pyramid, &c.

**SUMMONS,** in Scots law. See LAW, Tit. xxx. 28.

**SUN,** in astronomy. See ASTRONOMY, p. 435.

**SUN-FLOWER** in botany. See HELIANTHUS.

**SUNDA-ISLANDS,** those situated near the straits of Sunda, in the Indian ocean; the chief of which are Borneo, Java, Sumatra, &c. See BORNÉO, &c.

**SUNDAY,** or the LORD'S-DAY, a solemn festival observed by Christians on the first day of every week, in memory of our Saviour's resurrection.

This is the principal and most noted of the Christian festivals, and was observed with great veneration in the ancient church, from the time of the apostles, who themselves are often said to have met on that day for divine service. It is likewise called the Sabbath-day, as being substituted in the room of the Jewish sabbath. See SABBATH.

The ancients retained the name Sunday, or *dies solis*, in compliance with the ordinary forms of speech, the first day of the week being so called by the Romans, because it was dedicated to the worship of the sun.

**SUNDERLAND** a port-town of Durham, situated on the German sea, at the mouth of the river Wear, ten miles north-east of Durham city.

**SUNTGOW,** a territory in the circle of the upper Rhine in Germany, bounded by Alsace on the north; by the river Rhine, which divides it from the Brisgaw, on the east; by Switzerland on the south; and by Franche-Compte on the west.

**SUOVETAURILIA,** an ancient Roman sacrifice, so called because it consisted of a pig (*sus*), a sheep, or rather ram (*ovis*), and a bull (*taurus*). They were all males, to denote the masculine courage of the Roman people. It was likewise called solitauria, because the animals offered up were always (*solida*) whole or uncut.

**SUPERCARGO,** a person employed by merchants to go a voyage, and oversee their cargo, or lading, and dispose of it to the best advantage.

**SUPERCILIUM,** in anatomy. See ANATOMY, p. 294.

**SUPEREROGATION,** in theology, what a man does beyond his duty, or more than he is commanded to do.

**SUPERFETATION,** a second, or after conception, happening, when the mother, already pregnant, conceives of

a latter coition; so that she bears at once two fetuses of unequal age and bulk, and is delivered of them at different times. We meet with instances of superfetations in Hippocrates, Aristotle, Du Laurens, &c. But they are said to be much more frequent in hares and sows. Naturalists hold, that female rats are frequently born with young rats in their wombs; and we are told of extraordinary instances of this kind in the female part of the human species, by Bartholine, Mentzelius, and in the history of the Royal Academy of Sciences.

**SUPERFICIES,** or SURFACE, in geometry, a magnitude considered as having two dimensions; or extended in length and breadth, but without thickness or depth.

**SUPERFINE,** in the manufactories, a term used to express the superlative fineness of a stuff; thus a cloth, a camblet &c. are said to be superfine, when made of the finest wool, &c. or when they are the finest that can be made.

**SUPERINTENDANT,** in the French customs, an officer who has the prime management and direction of the finances or revenues of the king.

**SUPERIOR,** something raised above another, or that has a right to command another.

**SUPERIOR,** in Scots law. See LAW, Tit. x. 3.

**SUPERLATIVE,** in grammar, one of the three degrees of comparison, being that inflection of nouns-adjective that serves to augment and heighten their signification, and shews the quality of the thing denoted to be in the highest degree. See GRAMMAR.

**SUPERNUMERARY,** something over and above a fixed number. In several of the offices are supernumerary clerks, to be ready on extraordinary occasions.

**SUPERSEDEAS** in law, is a writ which lies in divers cases, and in general signifies a command to stay some of the ordinary proceedings in law, which, on good cause shewn, ought not to proceed.

**SUPERSTITION,** extravagant devotion, or religion wrong directed or conducted.

**SUPERVISOR,** a surveyor or overseer.

It was formerly, and still remains, a custom among some persons, to appoint a supervisor of a will, to see that the executors thereof do punctually observe and perform the same.

**SUPINATION,** in anatomy, the action of a supinator-muscle, or the motion whereby it turns the hand so as that the palm is lifted up towards heaven.

**SUPINATOR,** in anatomy. See ANATOMY, p. 198.

**SUPPLEMENT,** in matters of literature, an appendage to a book, to supply what is wanting therein.

**SUPPORTED,** in heraldry, a term applied to the uppermost quarters of a shield when divided into several quarters, these seeming as it were supported or sustained by those below. The chief is said to be supported when it is of two colours, and the upper colour takes up two thirds of it. In this case it is supported by the colour underneath.

**SUPPORTERS,** in heraldry, figures in an achievement placed by the side of the shield, and seeming to support or hold up the same. Supporters are chiefly figures of beasts; figures of human creatures, for the like purpose, are properly called tenants.

**SUPPOSITORY,** a kind of medicated cone, or ball, which is introduced to the anus for opening the belly. Suppositories

fitories are usually made of soap, sugar, alum, or a piece of tallow-candle, about the length of a man's thumb and the breadth of a finger, though they may be made smaller for children, and sometimes a little thicker for adults.

**SUPPRESSION**, in law, the extinction or annihilating of an office, right, rent, or the like.

**SUPPRESSION**, in medicine, is generally used for a retention of urine or the menfes. See **MEDICINE**, p. 160, 162.

**SUPPURATION**, the second way wherein an inflammation terminates, being a conversion of the inspissated blood and the soft adjacent parts, as the vessels and fat, into pus, or matter: which disorder, when it has not yet found an opening, is generally called an abscess. See **MEDICINE** and **SURGERY**.

**SUPPURATIVES**, or **SUPPURATING MEDICINES**, such as promot supuration. See the preceding article.

**SUPRACOSTALES**, in anatomy. See **ANATOMY**, p. 215.

**SUPRALAPSARY**, in theology, a person who holds that God, without any regard to the good or evil works of man, has resolved, by an eternal decree, to save some and damn others. These are also called antelapsaries, and are opposed to sublapsaries and infralapsaries.

**SUPRASPINATUS**, in anatomy. See **ANATOMY**, p. 196.

**SUPREMACY**, the superiority or sovereignty of the king. **SURAT**, a city and port-town of Huther India, in the province of Guzurat, or Cambaya, situated on the river

Tapte, ten miles east of the Indian sea: in E. long. 72° 20', N. lat. 21° 30'.

**SURCHARGE**, the same with overcharge, and whatever is above that which is just and right.

**SURCOAT**, a coat of arms to be worn over the body armour.

The furcoat is properly a loose thin taffaty coat, with arms embroidered or painted on it, such as is worn by heralds: anciently also used by military men over their armour, to distinguish themselves by.

**SURCULUS**, in the anatomy of plants, a word used to express that part of the branching of the ribs of a leaf, which is of a middle kind betwixt the great middle rib and the smallest reticular ramifications.

**SURD**. See **ALGEBRA**, p. 95.

**SURETY**, in law, generally signifies the same with bail. See **BAIL**.

**SURFACE**. See **SUPERFICIES**.

**SURFEIT**, in medicine a sickness proceeding from the sensation of a load at the stomach, usually attended with eruptions, and sometimes with a fever. See **MEDICINE**.

**SURGE**, in the sea-language, the same with wave. See **WAVE**.

Also when heaving at the capstan, if the cable royal or messenger slip a little, they call it surging.

## S U R G E R Y.

**SURGERY**, the art of curing all manner of wounds, and other disorders, where the application of the hand, assisted by proper instruments, is necessary.

### Of PHLEBOTOMY.

We begin with the operation of phlebotomy: because it is of all the most general, performed in most parts of the body, and by much the most frequent in use at this present day. By phlebotomy, or bleeding, we here intend the opening a vein, by a sharp-edged and pointed instrument of steel, for extracting a proper quantity of blood, either for the preservation or recovery of a person's health.

It is commonly enough known, that the operation of bleeding in the arm is performed on the veins that lie on the internal part of the cubit. There are several things worthy the surgeon's notice in this operation; some of which regard the things which are to be done preparatory to bleeding, some in the operation itself, others immediately after the performance of it. Preparatory to bleeding you should have in readiness (1.) A linen filler, about an ell in length, and two fingers in breadth. (2.) Two small square bolsters. (3.) Paringers or vessels to receive the blood. (4.) A sponge with warm water. (5.) Some vinegar, wine, or Hungary water, to raise the patient's spirits if he should be inclinable to faint. (6.) Two assistants, one to hold the paringer, the other to reach you anything that you shall want. (7.) You must place your patient upon a couch; or, if he is so fearful of the operation, lay him upon a bed, lest he should fall into a swoon. Lastly, the operator should be as expert in bleeding with his left hand as with his right: For,

as you are readier at bleeding in the right arm with your right hand, so when you are to open the veins of the left arm you will find it necessary to use your left hand.

Though the operation is to be performed at once, with one puncture, yet many things are to be observed in order to render it successful. First, it is necessary for the surgeon to inspect his patient's arm diligently, that he may see the course of the veins: he must then take hold of the arm, and extend it towards his breast, tucking up the sleeve about a hand's breadth above the bend of the cubit, where he must make his ligature, rolling the fillet twice round, and fastening it with a knot. The veins being compressed, and the blood being stopped in its return, they will enlarge, and lie fairer to the eye. When you have bound up the arm in this manner, you let it go for a small time till the veins grow turgid. You are then to lay hold of the arm again in the same manner as we directed before, and extend it to your breast, having an assistant ready with the vessel in his hand, at a convenient distance for receiving the blood.

You are now to examine which vein lies fairest, and is therefore most proper to be opened. For you must observe, that in the arm there usually appear three principal veins. The first is called *Vena Cephalica*, and is found in the external part of the arm. The second is termed *Basilica*, and lies on the internal part of the arm: In the right arm it is also called *Hepatica*; in the left *Splenicica*. The third, which is obliquely situated between the former two, is called *Mediana*. The median and basilic veins, as they are larger than the cephalic, discharge a greater quantity of blood, but are attended with more danger in the operation:

For a considerable artery and the brachial nerve lie under the basilic vein, and the tendon of the biceps muscle under the median. But as they lie fairer to the eye, and are therefore more frequently the subjects of the operations we are treating of than the cephalic vein, it is safer and more eligible for the less experienced surgeons to open the basilic, or at least the median vein.

When you have determined which vein to open, you are to perform the operation on that part which presents itself fairest to you. But if the vein has frequently been opened, and the part which appears largest and fairest is full of cicatrices, you are not to open above, but below the cicatrices, by which means the blood will discharge itself more freely: For the part above is generally straitened by the cicatrix.

Before you apply the lancet to the skin, when the veins are not risen, it will be proper to rub the arm below the bandage, which will drive the blood back towards the cubit, and render the veins more turgid. Whilst this is doing in the right arm, the surgeon should take hold of the patient's arm in such a manner that he may lay his thumb upon the vein he intends to open, to prevent the blood from flowing back, and to keep the vein from rolling. You are now to fix your eye upon that part of the vein which you intend to open, and taking the lancet with your right hand, so placed that the thumb and first finger may be fixed about the middle of the blade; the other fingers should rest gently upon the patient's arm, to prevent your hand from slipping.

Your lancet is now to be pushed lightly and carefully forward by your thumb and fore-finger, till it has penetrated through the coats of the vein; and at that instant to be raised a little upwards, in order to enlarge the orifice of the wound, which will give a freer passage to the blood. The most common and convenient size of an orifice is about twice the breadth of the back of an ordinary knife. You are to keep even between the two extremes of rashness and timidity in making the puncture. For as in one case you will only divide the common integuments, and so leave your work undone; so in the other you will run the risque of wounding the artery, nerve, or tendon.

Your aperture being thus made, and the instrument drawn instantly back, the blood will then rush forth from the orifice either in a large or small stream. In the mean time the blood must be permitted to flow as long as it shall be judged useful or necessary; and if it should stop too soon, as it often may from too great a stricture of the bandage on the arm, it must be slackened a little, by which means the compressed artery being set at liberty, the blood will flow from the orifice as at first. If you find the orifice obstructed by too great a tension of the skin, or an intrusion of the *membrana adiposa*, you ought in that case to return the bit of fat, by pressing with the finger or a warm sponge, and to relax the skin by bending the arm a little. Lastly, if the orifice be obstructed by thick, grumous, or congealed blood, that impediment may be removed by wiping it with a sponge dipt in warm water.

But that the patient's arm may not become painful or languid, by holding it long extended, the surgeon should support it by the cubitus for a little while; and then give him a stick, or other cylindrical body, to turn round in his hand, that by the contractions of the flexor and extensor muscles of the fingers, the course of the blood may be accelerated towards the cubitus: which will still be further promoted, if the patient urges a little voluntary cough.

When there seems to be a sufficient quantity of blood discharged, the ligature must then be immediately taken off from above the elbow, and the skin about the orifice must next be gently stroked or pressed together by the two fore-fingers of the left-hand; by which means the lips of the divided vein are more easily compressed and closed. But while the surgeon is doing this with his left hand, he takes the smallest of the two compresses, and applies it upon the incision with his right-hand: but so as to let what little blood may remain betwixt the orifice and the vein, be discharged, before he imposes the compress. Over the first or small compress he should impose another that is a little larger, pressing them both gently on the orifice with his left thumb, till the bandage is laid across.

Having applied your bandage, and drawn down the patient's sleeve over his arm; he should be ordered not to use it too early or violently, before the orifice is well closed, which might excite a fresh hæmorrhage, an inflammation, suppuration, or other bad accident. And if the patient should faint away soon after the operation, it may be then convenient to wet his nostrils with Hungary water or vinegar; and to sprinkle some of the last, or else cold water, in his face; and, especially in summer-time, to let in the fresh and cool air, by opening the windows, &c. Also, if any wine or cordial water be at hand, you may give the languishing patient a small draught thereof.

#### Of BLEEDING in the FOOT.

BLEEDING in the foot is an operation of very old standing: it having been an observation made by the most ancient physicians, that phlebotomy in this part proved highly serviceable in most disorders of the head and breast, and for an obstruction of the menstrual and hæmorrhoidal flux; upon which discharges greatly depended the healthy state of both sexes. For these reasons they therefore denominated those veins of the foot, *Saphena* and *Cephalica*: the last of which extends itself from the internal ancle to the great toe; and the first, from the external *malleolus* to the smaller toes. But why one of them should be thought or denominated more cephalic than the other, there is not the least reason to be offered; since bleeding from either of them has altogether the very same effect. Therefore, the surgeon should always open that which lies fairest and most conspicuous. But if the veins upon the *metatarsus*, or instep of the foot, do not well appear, it may then be convenient to open one of those at the ancle, or about the calf or ham of the leg. Nor is the phlebotomist so liable to injure any of the tendons in these last parts as he is upon the *metatarsus*.

For the more easy and successful apertion of these veins, the patient must first wash both feet well for some time in hot water; that when the veins become sufficiently turgid, the surgeon may take his choice of that which presents fairest either in the right or left foot, without paying any deference to the distinction of right or left in any of the fore-mentioned disorders. Having fixed upon the particular foot and vein, your ligature must be applied about two fingers breadth above the ancle; and then the patient must return it into the warm water, while the surgeon takes out and prepares his instrument or lancet. Then kneeling down on one knee, the surgeon takes out the patient's foot from the warm water, and having wiped it dry with a napkin, places it upon his other knee, or else upon a board laid over the vessel of hot

hot water. He now fastens or secures down the vein from slipping with his left hand. But if the veins do not appear well under the ancles, the ligature must be removed higher, about two fingers breadth above where you intend to make the aperture of the vein which best offers itself.

The blood from the vein thus opened may be received into a basin; and if it does not flow freely from the orifice, the foot should be returned into the warm water, which will either prevent or dissolve the congealing of the blood that in this case often obstructs the aperture. When a sufficient quantity of blood has been thus drawn, which may be known partly from the time, and partly from the largeness of the stream, as also from the redness of the water, and condition or strength of the patient; the orifice is then to be closed by the finger, and after drying the foot with a napkin, to be secured by compresses and bandages.

#### *Of BLEEDING in the Veins of the FOREHEAD, TEMPLES, and OCCIPUT.*

THERE are many physicians and surgeons, who think that bleeding by the veins of the forehead and temples is much more serviceable and expeditious in relieving all disorders of the head, such as violent pains, vertigo, delirium, melancholy, and raving madness, &c. than the like discharge by veins more remote from the parts affected; judging that their vicinity renders them more capable of evacuating the offending matter of the disease. Before proceeding to cut the veins, an handkerchief or neckcloth ought to be drawn tight round the neck; that, by compressing the jugular vein, those branches of it may become more turgid and conspicuous. The vein being opened, the patient must hold down his head, that the blood may not trickle from his forehead into his eyes or mouth, when the stream does not spin out with sufficient force. If the blood does not stop of itself after a due quantity is discharged, you must compress the orifice with your finger; and, after wiping the forehead and face, apply a compress or two, and then your bandage.

Bleeding from the occipital veins, which communicate with the lateral sinusses of the *dura mater*, is both by reason and experience proved to be serviceable in most disorders of the brain, where that part is overcharged with blood, which may be this way diverted and evacuated. The celebrated anatomist Morgagni especially recommends it, with scarification and cupping in those parts, for all lethargic disorders.

#### *Of BLEEDING in the JUGULAR VEINS of the NECK.*

IT has been a very ancient practice to bleed in the external jugular veins of the neck, for most inflammatory disorders of the adjacent parts, for a quinsy, phrenzy, madness, ophthalmia, apoplexy, inveterate head-aches, lethargy, and other disorders of the head. Nor are there wanting many among our modern surgeons and physicians to encourage the same practice, and that even from the authority of reason and experience; since the accumulated and obstructed blood and humours may be this way discharged from the parts affected, and their bad consequences prevented. Nor is the operation at all dangerous; since the jugular veins run on each side the neck from the head to the clavicles, immediately under the skin, and appearing generally very large, they may be easily perceived and opened: before which, you must make a stricture upon the lower part of the neck with a handkerchief, or the common ligature,

which must be drawn tight by an assistant or the patient, to make the vein turgid and conspicuous.

When the jugular veins have been by this means rendered turgid and conspicuous, either of them which appears plainest may be secured by the finger for incision, either in the right or left side of the neck indifferently; when the disorder lies in the whole head, or in the neck and fauces. But when only one side of the head, or one eye, is affected, the vein ought to be opened on the disordered side of the neck. The requisite quantity of the blood being taken, the ligature is next removed, and the orifice compressed with your finger, if the blood does not stop without while you wipe clean the neck, and then apply your compress and circular bandage. Thus the blood stops without any danger of a fresh hæmorrhage. Lastly, it must be acknowledged, that the patient faints away as readily after bleeding in the neck, as the jugular veins are safely and easily opened: but no danger follows from thence.

#### *Of BLEEDING in the VEINS, called Ranulæ, under the Tongue.*

IT is very often found of no small service in a quinsy, or other inflammatory disorder of the neck, to bleed in the two small veins which run under the tip or end of the tongue: especially if a larger vein has been opened before, either in the neck, foot, or arm, whereby the inspissated and stagnated blood may be gradually evacuated. To bleed in these veins, a stricture being made upon the neck as before, you then elevate the *apex* of the tongue with your left hand, while, with the lancet in your right, you circumspectly open first one, and then the other on each side; because the aperture of one only will hardly ever discharge blood enough to give any considerable relief. When you judge a sufficient quantity of blood has run out of the mouth into your vessel, remove the ligature from the neck: upon which the flux usually stops of itself. But if it should still continue, let the patient take a little vinegar or *Frontinac* wine in his mouth: or else you may apply a bit of vitriol or alum, or a compress dipt in some styptic liquor, till the hæmorrhage ceases; which can never be dangerous even without such topics.

#### *Of PHLEBOTOMY in the PENIS.*

BLEEDING in the *vena dorsalis penis* usually surpasses the benefit of all remedies whatever in abating inflammatory disorders of this member. This large vein, which runs along the back or upper side of the *penis*, being generally pretty much distended, and conspicuous in an inflammation of this part, may be incised about the middle or back part of the penis; and kept bleeding till the member becomes flaccid, and a sufficient quantity of blood be discharged proportionable to the urgency of the symptoms. This done, you must apply a compress, and the bandage proper for the penis. But you must carefully endeavour to avoid injuring the arteries or nerves which enter the penis near this vein; as also not to make your bandage too strict: for by these means the inflammation and symptoms may turn out worse than before.

#### *Of WOUNDS.*

To conceive rightly of the nature and treatment of wounds, under the variety of disorders that they are subject to, it will be proper first to learn, what are the appearances in

the progress of healing a large wound, when it is made with a sharp instrument, and the constitution is pure.

In this circumstance, the blood-vessels, immediately upon their division, bleed freely, and continue bleeding till they are either stopped by art, or at length contracting and withdrawing themselves into the wound, their extremities are shut up by the coagulated blood. The hæmorrhage being stopped, the next occurrence, in about twenty-four hours, is a thin serous discharge; and, a day or two after, an increase of it, though somewhat thickened, and sinking. In this state it continues two or three days without any great alteration, from which time the matter grows thicker and less offensive; and when the bottom of the wound fills up with little granulations of flesh, it diminishes in its quantity, and continues doing so till the wound is quite skinned over.

The first stage of healing, or the discharge of matter, is by surgeons called *digestion*: the second, or the filling up with flesh, *incarnation*; and the last, or skinning over, *cicatrisation*.

It is worth observing, that the loss of any particular part of the body can only be repaired by the fluids of that distinct part; and as in a broken bone, the *callus* is generated from the ends of the fracture, so, in a wound, is the cicatrix from the circumference of the skin only: Hence arises the necessity of keeping the surface even, either by pressure or eating medicines, that the eminence of the flesh may not resist the fibres of the skin in their tendency to cover the wound. This eminence is composed of little points or granulations called *fungus*, or proud flesh, and is frequently esteemed an evil, though in truth this species of it be the constant attendant on healing wounds; for when they are smooth, and have no disposition to shoot out above their lips, there is a slackness to heal, and a cure is very difficultly effected. Since then a *fungus* prevents healing only by its luxuriance, and all wounds cicatrize from their circumference, there will be no occasion to destroy the whole *fungus* every time it rises, but only the edges of it near the lips of the skin; which may be done by gentle escharotics, such as lint dipt in a mild solution of *vitriol*, or for the most part only by dry lint, and a tight bandage, which will reduce it sufficiently to a level, if applied before the *fungus* have acquired too much growth. In large wounds, the application of corrosive medicines to the whole surface, is of no use; because the *fungus* will attain but to a certain height, when left to itself, which it will be frequently rising up to, though it be often wasted; and as all the advantage to be gathered from it, is only from the evenness of its margin, the purpose will be as fully answered by keeping that under only, and an infinite deal of pain avoided from the continual repetition of escharotics.

From what has been said of the progress of a wound made by a sharp instrument, where there is no indisposition of body, we see the cure is performed without any interruption, but from the *fungus*; so that the business of surgery will consist principally in a proper regard to that point, and in applications that will the least interfere with the ordinary course of nature, which in these cases will be such as act the least upon the surface of the wound; and agreeably to this we find, that dry lint only is generally the best remedy through the whole course of dressing: at first, it stops the blood with less injury than any styptic powders or waters; and afterwards, by absorbing the matter, which in the be-

ginning of suppuration is thin and acrimonious, it becomes in effect a digestive: during incarnation it is the softest medium that can be applied between the roller and tender granulations, and at the same time is an easy compress upon the sprouting *fungus*.

Over the dry lint, may be applied a pledgit of some soft ointment spread upon tow, which must be renewed every day, and preserved in its situation by a gentle bandage; though in all large wounds, the first dressing, after that of the accident or operation, should not be applied in less than three days, when, the matter being formed, the lint separates more easily from the part; in the removal of which, no force should be used, but only so much be taken away as is loose and comes off without pain.

#### Of INFLAMMATIONS and ABSCESSSES.

As almost all abscesses are the consequences of inflammations, and these produce a variety of events, as they are differently complicated with other disorders, it will be proper first to make some inquiry into their disposition. Inflammations from all causes have three ways of terminating; either by dispersion, suppuration, or gangrene.

But though every kind of inflammation will sometimes terminate in different shapes, yet a probable conjecture of the event may be always gathered from the state of the patient's health. Thus inflammations happening in a slight degree upon colds, and, without any foregoing indisposition, will most probably be dispersed; those which follow close upon a fever, or happen to a very gross habit of body, will generally impothumate: and those which fall upon very old people, or dropical constitutions, will have a strong tendency to gangrene.

If the state of an inflammation be such, as to make the dispersion of it safely practicable, that end will be best brought about by evacuations, such as plentiful bleeding and repeated purges: the part itself must be treated with fomentations twice a day; and if the skin be very tense, it may be embrocated with a mixture of three fourths of oil of roses, and one fourth of common vinegar, and afterwards covered with *unguent flor samb.* or a soft ointment made of white wax and sweet oil, spread upon a fine rag, and rolled on gently. If after four or five days, the inflammation began to subside, the purging-waters and *maëna* may take place of other purges, and the embrocation of oil and vinegar be now omitted, or sooner, if it has begun to excoriate. The ointment of wax and oil may be continued to the last. During the cure a thin diet is absolutely necessary, and in the height of the inflammation the drinking of thin liquors is of great service.

Here we have supposed that the inflammation had so great a tendency to discussion, as, by the help of proper assistance, to terminate in that manner; but when it happens that the disposition of the tumour rests in all discutient means, we must then desist from any farther evacuations, and assist nature in the bringing on a suppuration.

That matter will most likely be formed, we may judge from the increase of the symptomatic fever, and enlargement of the tumour, with more pain and pulsation; and if a small rigor come on, it is hardly to be doubted. Inflammations after a fever, and the small-pox, almost always suppurate; but these presently discover their tendency, or at least should be at first gently treated, as though we expected an impothumation. It is a maxim laid down in surgery,

gery, that evacuations are pernicious in every circumstance of a disease, which is at last to end in suppuration: But as physicians do now acknowledge, that bleeding on certain occasions in the small-pox, is not only no impediment to the maturation, but even promotes it; so in the formation of abscesses, when the vessels have been clogged, and the suppuration has not kindly advanced, bleeding has sometimes quickened it accordingly; but, however, this practice is to be followed with caution. Purges are, no doubt, improper at this time; yet if the patient be constive, he must be assisted with gentle clysters every two or three days.

Of all the applications invented to promote suppuration, there are none so easy as poultices; but as there are particular tumours very slow of suppuration, and almost void of pain (such, for instance, are some of the scrophulous swellings) it will be less troublesome in these cases to wear the gum-plasters, which may be renewed every four or five days only. Amongst the suppurative poultices, perhaps there is none preferable to that made of bread and milk softened with oil; at least the advantage of any other over it is not to be distinguished in practice. The abscess may be covered with the poultice twice a-day, till it come to that ripeness as to require opening, which will be known by the thinness and eminence of the skin in some part of it, a fluctuation of the matter, and generally speaking, an abatement of the pain previous to these appearances.

The signs of a gangrene are these: the inflammation loses its redness, and becomes dusky and livid; the tenderness of the skin goes off, and feels to the touch flabby or emphysematous; vesications filled with ichor of different colours spread all over it; the tumour subsides, and, from a dusky complexion, turns black; the pulse quickens and sinks, and profuse sweats coming on, at last grow cold, and the patient dies.

To stop the progress of a mortification, the method of treatment will be nearly the same, from whatever cause it proceed, except in that arising from cold: in which case, we ought to be cautious not to apply warmth too suddenly to the part, if it be true, that in the northern countries they have daily conviction of gangrenes produced by this means, which might have been easily prevented by avoiding heat; nay, they carry their apprehension of the danger of sudden warmth so far as to cover the part with snow first, which they say seldom fails to obviate any ill consequence.

The practice of scarifying gangrenes, by several incisions, is almost universal: and with reason; since it not only lets the parts free, and discharges a pernicious ichor, but makes way for whatever efficacy there may be in topical applications. These are different with different surgeons: but the digestives softened with oil of turpentine are as good dressings as any for the scarifications: and upon them, all over the part, may be laid the *theriaca Londinensis*, which should be always used in the beginning of a gangrene before the necessity of scarifying arises; or what is equally good, if not often preferable, a cataplasm made with lixivium and bran, and applied warm, which will retain its heat better than most other topicals. Medicines also given internally are beneficial, and these should consist of the cordial kind; but the bark is the sovereign remedy for this disorder: after the separation of the eschar, the wound becomes a common ulcer, and must be treated as such.

There are two ways of opening an abscess; either by incision, or caustick; but incision is preferable in most cases.

In small abscesses, there is seldom a necessity for greater dilatation than a little orifice made with the point of a lancet; and in large ones, where there is not a great quantity of skin discoloured and become thin, an incision to their utmost extent will usually answer the purpose; or if there be much thin discoloured skin, a circular or oval piece of it must be cut away; which operation, if done dexterously with a knife, is much less painful than by caustick, and at once lays open a great space of the abscess, which may be dressed down to the bottom, and the matter of it be freely discharged; whereas, after a caustick, though we make incisions through the eschar, yet the matter will be under some confinement; and we cannot have the advantage of dressing properly till the separation of the slough, which often requires a considerable time, so that the cure must be necessarily delayed; besides that the pain of burning continuing two or three hours, which a caustick usually requires in doing its office, draws such a suction upon the skin round the eschar, as sometimes to indurify it very much for healing afterwards. In the use of causticks, it is but too much a practice, to lay a small one on the most prominent part of a large tumour, which not giving sufficient vent to the matter, and perhaps the orifice soon after growing narrow, leads on to the necessity of employing tents; which two circumstances more frequently make fistulas after an abscess, than any malignity in the nature of the abscess itself. The event would more certainly be the same after a small incision; but surgeons not depending so much on small openings by incision, as by caustick, do, when they use the knife, generally dilate sufficiently; whereas, in the other way, a little opening in the most depending part of the tumour usually fastens them.

From this account of the method of opening abscesses, it does not appear often necessary to apply causticks; yet they have their advantages in some respects, and are seldom so terrible to patients as the knife, though in fact they are frequently more painful to bear. They are of most use in cases where the skin is thin and inflamed: and we have reason to think the malignity of the abscess is of that nature as to prevent a quickness of incarning; in which circumstance, if an incision only were made through the skin, little sinuses would often form, and burrow underneath, and the lips of it lying loose and flabby, would become callous, and retard the cure, though the malignity of the wound were corrected: of this kind are venereal buboes; which notwithstanding they often do well by mere incision, yet when the skin is in the state we have supposed, the caustick is always preferable: but this method should be confined to venereal buboes; for those which follow a fever, or the small-pox, for the most part are curable by incision only. There are many scrophulous tumours, where the reasoning is the same as in the venereal: and even in great swellings if the patient will not submit to cutting, and the surgeon is apprehensive of any danger in wounding a large vessel, which is often done with the knife, yet as this inconvenience is avoided by caustick, it may on such an occasion be made use of; however, in scrophulous swellings of the neck and face, unless they are very large, causticks are not advisable, since in that part of the body, with length of time, they heal after incision. Causticks are of great service in destroying stubborn scrophulous indurations of the glands, also venereal indurations of the glands of the groin, which will neither discuss nor suppurate; likewise in exposing carious bones, and

making

making large issues. The best caustick in use is a paste made with lime and *lixivium capitale*, which is to be prevented from spreading, by cutting an orifice in a piece of sticking plaister, nearly as big as you mean to make the eschar; which being applied to the part, the caustick must be laid on the orifice, and preserved in its situation by a few slips of plaister laid round its edges, and a large piece over the whole. When issues are made, or bones exposed, the eschar should be cut out immediately, or the next day: for if we wait the separation, we miscarry in our design of making a deep opening; since sloughs are flung off by the sprouting new flesh underneath, which fills up the cavity at the same time that it discharges the eschar; so that we are obliged afterwards to make the opening a second time with painful escharotick medicines. To make an issue, or lay a bone bare, this caustick may lie on about four hours; to destroy a large gland, five or six; and to open abscesses, an hour and a half, two hours, or three hours, according to the thickness of the skin; and what is very remarkable, notwithstanding its strength and sudden efficacy, it frequently gives no pain where the skin is not inflamed, as in making issues, and opening some few abscesses.

When an abscess is already burst, we are to be guided by the probe where to dilate, observing the same rules with regard to the degree of dilatation as in the other case. The usual method of dilating, is with the probe-scissars; and indeed, in all abscesses, the generality of surgeons use the scissars, after having first made a puncture with a lancet: but as the knife operates much more quickly, and with less violence to the parts than scissars, which squeeze at the same time that they wound, it will be sparing the patient a great deal of pain to use the knife, where-ever it is practicable, which is in almost all cases, except some fistula's *in ano*, where the scissars are more convenient. The manner of opening with a knife, is by sliding it on a director, the groove of which prevents its being misguided. If the orifice of the abscess be so small as not to admit the director, or the blade of the scissars, it must be enlarged by a piece of sponge-tent; which is made by dipping a dry bit of sponge in melted wax, and immediately squeezing as much out of it again as possible, between two pieces of tile or marble; the effect of which is, that the loose sponge being compressed into a small compass, if any of it be introduced into an abscess, the heat of the part melts down the remaining wax that holds it together, and the sponge sucking up the moisture of the abscess, expands, and in expanding opens the orifice wider, and by degrees, so as to give very little pain.

The usual method of dressing an abscess, the first time, is with dry lint only; or if there be no flux of blood, with soft digestives spread on lint. If there be no danger of the upper part of the wound reuniting too soon, the dossils must be laid in loose; but if the abscess be deep, and the wound narrow, as is the case sometimes of abscesses *in ano*, the lint must be crammed in pretty tightly, that we may have afterwards the advantage of dressing down to the bottom without the use of tents, which, by resisting the growth of the little granulations of flesh, in process of time harden them, and in that manner produce a fistula: so that, instead of being used for the cure of an abscess, they never should be employed but where we mean to retard the healing of the external wound, except in some little narrow abscesses, where, if they be not crammed in too large, they become, as dossils, admitting of incarnation at the bottom; but care

should be taken, not to insinuate them much deeper than the skin in this case, and that they should be repeated twice a day, to give vent to the matter they confine. But tents do most good in little deep abscesses, whence any extraneous body is to be evacuated, such as small splinters of bone, &c.

The use of vulnerary injections into abscesses has been thought to bear so near a resemblance to the use of tents, that they both fell into disrepute almost at the same time.

Over the dossils of lint may be laid a large pledgit of tow spread with basilicon, which will lie softer than a defensive plaister; for this, though designed to defend the circumference of wounds against inflammation or a fluxion of humours, is often the very cause of them; so that the dressings of large wounds should never be kept on by these plaisters, where there is danger of such accidents. In this manner, the dressings may be continued, till the cavity is incarned; and then it may be cicatrised with dry lint, or some of the cicatrising ointments, observing to keep the *fungus* down, as directed before.

In the course of dressing it will be proper to have regard to the situation of the abscess, and as much as possible to make the patient favour the discharge by his ordinary posture: and to this end also, as what is of greater importance than the virtue of any ointment, the discharge must be assisted by compress and bandage: the compress may be made of rags or plaister; though the latter is sometimes preferable, as it remains immovable on the part it is applied to. The frequency of dressing will depend on the quantity of discharge: once in twenty-four hours is ordinarily sufficient; but sometimes twice, or perhaps three times, is necessary.

#### OF ULCERS.

WHEN a wound or abscess degenerates into so bad a state as to resist the methods of cure above laid down, and loses that completion which belongs to a healing wound, it is called an ulcer; and as the name is generally borrowed from the ill habit of the sore, it is a custom to apply it to all sores that have any degree of malignity, though they be immediately formed without any previous abscess or wound; such are the venereal ulcers of the tonsils, &c.

Ulcers are distinguished by their particular disorders, though it seldom happens that the affections are not complicated; and when we lay down rules for the management of one species of ulcer, it is generally requisite to apply them to almost all others. However, the characters of most eminence are, the callous ulcer, the sinous ulcer, and the ulcer with caries of the adjacent bone; tho' there be abundance more known to surgeons, such as the putrid, the corrosive, the varicous, &c. but as they have acquired their names from some particular affection, we shall speak of the treatment of them under the general head of ulcers.

It will be often in vain to pursue the best means of cure by topical application, unless we are assisted by internal remedies; for as many ulcers are the effects of a particular indispotion of body, it will be dimcult to bring them into order, while the cause of them remains with any violence; though they are sometimes in a great degree the discharge of the indispotion itself, as in the plague, small-pox, &c. But we see it generally necessary in the pox, the scurvy, obstructions of the menses, dropics, and many other distempers, to give internals of great efficacy; and indeed, there are hardly any constitutions where ulcers are not assisted by some physical regimen. Those that are cancerous and

and scrophulous seem to gain the least advantage from physic; for if in their beginnings they have sometimes been very much relieved, or cured, by salivation, or any other evacuation, they are also often irritated and made worse by them; so that there is nothing very certain in the effects of violent medicines in these distempers. Upon the whole, in both these cases, the milk-diet, and gentle purgings with manna, and the waters, seem to be most efficacious; though brisk methods may be used with more safety in the evil than in the cancer; and sometimes, particularly in young subjects, the decoction of the woods is extremely beneficial for scrophulous ulcers: but it has lately been attested by men of great skill and veracity, that sea-water is more powerful than any other remedy hitherto known, both for scrophulous ulcers, and scrophulous tumours.

When an ulcer becomes foul, and discharges a nasty thin ichor, the edges of it, in process of time, tuck in, and growing skinned and hard, give it the name of a callous ulcer, which, so long as the edges continue in that state, must necessarily be prevented from healing: But we are not immediately to destroy the lips of it, in expectation of a sudden cure; for while the malignity of the ulcer remains, which was the occasion of the callosity, so long will the new lips be subject to a relapse of the same kind, however often the external surface of them be destroyed: so that when we have to deal with this circumstance, we are to endeavour to bring the body of the ulcer into a disposition to recover by other methods. It sometimes happens to poor laborious people, who have not been able to afford themselves rest, that lying a-bed will in a short time give a diversion to the humours of the part, and the callous edges softening, will without any great assistance shoot out a cicatrix, when the ulcer is grown clean and filled with good flesh: the effect of a salivation is generally the same; and even an issue does sometimes dispose a neighbouring ulcer to heal: but though callosities be frequently softened by these means, yet when the surface of the ulcer begins to yield thick matter, and little granulations of red flesh shoot up, it will be proper to quicken nature by destroying the edges of it, if they remain hard. The manner of doing this, is by touching them a few days with the lunar caustick, or *lapis infernalis*; and some chuse to cut them off with a knife: but this last method is very painful, and not more efficacious; though when the lips do not tuck down close to the ulcer, but hang loose over it, as in some venereal buboes, where the matter lies a great way under the edges of the skin, the easiest method is cutting them off with the scissars.

To digest the ulcer, or to procure good matter from it when in a putrid state, there are an infinity of ointments invented; but the *Basilicon Flavum* alone, or softened down sometimes with turpentine, and sometimes mixt up with different proportions of red precipitate, seems to serve the purposes of bringing an ulcer on to cicatrification as well as any of the others. When the ulcer is incarnated, the cure may be finished as in other wounds; or if it do not cicatrise kindly, it may be washed with *Aq. Calcis*, or *Aq. Phag.* or dressed with a pledgit dipt in *Tinct. Myrrhae*: and if excoarations are spread round the ulcer, they may be anointed with *Sperm. Cet.* ointment, or *Unguent. Nutritum*.

The *Red Precipitate* has of late years acquired the credit it deserves for the cure of ulcers; but by falling into general use, is very often unskillfully applied: when mixed with the *Basilicon*, or, what is neater, a cerate of wax and oil, it is

most certainly a digestive, since it hardly ever fails to make the ulcer yield a thick matter in twenty-four hours, which discharged a thin one before the application of it.

If the ulcer should be of such a nature as to produce a spongy flesh, sprouting very high above the surface, it will be necessary to destroy it by some of the escharoticks, or the knife. This fungus differs very much from that belonging to healing wounds, being more eminent and lax, and generally in one mass; whereas the other is in little distinct protuberances. It approaches often towards a cancerous complexion, and when it rises upon some glands does actually degenerate sometimes into a cancer. When these excrescences have arisen in venereal ulcers, escharoticks should be applied. Those in use, are the *Vitriol*, the *Lunar-Caustick*, the *Lapis Infernalis*, and more generally the red *Precipitate* powder.

It is but seldom, that these inveterate funguses appear on an ulcer; but it is very useful for those of a milder kind to rise, which may often be made to subside with pressure, and the use of mild escharoticks: however, if the aspect of the fore be white and smooth, as happens in ulcers accompanied with a dropsy, and often in young women with obstructions, it will answer no purpose to waste the excrescences, until the constitution is repaired, when most probably they will sink without any assistance. In ulcers also, where the subjacent bone is carious, great quantities of loose flabby flesh will grow up above the level of the skin: but as the caries is the cause of the disorder, it will be in vain to expect a cure of the excrescence, until the rotten part of the bone be removed; and every attempt with escharoticks will be only a repetition of pain to the patient without any advantage.

When the excrescence is cancerous, and does not rise from a large cancer, but only from the skin itself, it has been usual to recommend the actual cautery; but it is better to cut away quite underneath, and dress afterwards with easy applications. As to the treatment of incurable cancerous ulcerations, after much trial, surgeons have at last discovered, that what gives the most ease to the sore is the most suitable application; and therefore the use of escharoticks is not to be admitted on any pretence whatsoever; nor in those parts of a cancer that are corroded into cavities, must the precipitate be made use of to procure digestion, or promote the separation of the sloughs. The best way, therefore, is to be guided by the patient what medicine to continue. Those usually prescribed are preparations from lead; but what we have found most beneficial, have been sometimes dry lint alone when it does not stick to the cancer; at other times, lint dissolved spread with *Basilicon* or *Cerat. de Lapid. Galan.* and oftener than either with a *Cerate* made of oil and wax, or the *Sperm. Cet.* ointment; and over all, a pledgit of tow spread with the same. Embrocating the neighbouring skin and edges of it with milk, is of service; but the chief good is to be acquired by diet, which should be altogether of milk and things made of milk, though herbage may be admitted also. Issues in the shoulders or thighs do also alleviate the symptoms; and manna, with the purging waters, once, or perhaps twice a-week, will serve to keep the body cool.

When ulcers or abscesses are accompanied with inflammation and pain, they are to be assisted with fomentations made of some of the dry herbs, such as Roman wormwood, bay-leaves, and rosemary; and when they are very putrid and corrosive which circumstances give them the name of foul phagedenic ulcers, some spirits of wine should be added to the fomentation, and the bandage be also dipt in brandy

or spirits of wine, observing in these cases where there is much pain, always to apply gentle medicines till it be removed.

When the pain and inflammation are excessive, bleeding and other evacuations will often be serviceable: and above all things, rest and a horizontal position which last circumstance is of so great importance to the cure of ulcers of the legs, that unless the patient will conform to it strictly, the skill of the surgeon will often avail nothing; for as the indisposition of these fores is in some measure owing to the gravitation of the humours downwards, it will be much more beneficial to lie along than sit upright, though the leg be laid on a chair; since even in this posture they will descend with more force, than if the body was reclined.

In ulcers of the legs, accompanied with varices or dilations of the veins, the method of treatment will depend upon the other circumstances of the fore; for the varix can only be assisted by the application of bandage, which must be continued a considerable time after the cure. The neatest bandage is the strait stocking, which is particularly serviceable in this case; though also, if the legs be œdematous, or if, after the healing of the ulcers, they swell when the patient quits his bed, it may be worn with safety and advantage. There are instances of one vein only being varicous, which when it happens, may be destroyed by tying it above and below the dilation, as in an aneurism; but this operation should only be practised where the varix is large and painful.

Ulcers of many years standing are very difficult of cure; and in old people the cure is often dangerous, frequently exciting an asthma, a diarrhoea, or a fever, which destroys the patient, unless the fore break out again: so that it is not altogether advisable to attempt the absolute cure in such cases, but only the reduction of them into better order, and less compass, which, if they be not malignant, is generally done with rest and proper care. The cure of those in young people may be undertaken with more safety; but we often find it necessary to raise a salivation to effect it, though, when completed it, does not always last; so that the prospect of cure in stubborn old ulcers, at any time of life, is but indifferent. In all these cases, however, it is proper to purge once or twice a-week with calomel, if the patient can bear it, and to make an issue when the fore is almost healed, in order to continue a discharge the constitution has been so long habituated to, and prevent its falling from the cicatrix, and bursting out again in that place.

When an ulcer or abscess has any sinuses or channels opening and discharging themselves into the fore, they are called sinuous ulcers. These sinuses, if they continue to drain a great while, grow hard in the surface of their cavity, and then are termed fistulae, and the ulcer a fistulous ulcer; also, if matter be discharged from any cavity, as those of the joints, abdomen, &c. the opening is called a sinuous ulcer, or a fistula.

The treatment of these ulcers depends upon a variety of circumstances. If the matter of the sinus be thick, strict bandage and compress will sometimes bring the opposite sides of the sinus to a re-union: if the sinus grow turgid in any part, and the skin thinner, shewing a disposition to break, the matter must be made to push more against that part, by plugging it up with a tent; and then a counter opening must be made, which proves often sufficient for the whole abscess, if it be not afterwards too much tented, which locks up the matter and prevents the healing; or

too little, which will have the same effect; for dressing quite superficially, does sometimes prove, as mischievous as tents, and for nearly the same reason, since suffering the external wound to contract into a narrow orifice before the internal one be incured, does almost as effectually lock up the matter as a tent: to preserve then a medium in these cases, a hollow tent of lead or silver may be kept in the orifice, which, at the same time that it keeps it open, gives vent to the matter. The abscesses where the counter opening are made most frequently, are those of compound fractures, and the breast; but the latter do oftner well without dilatation than the former, though it must be performed in both, if practicable, the whole length of the abscess, when after some trial the matter does not lessen in quantity, and the sides of it grow thinner; and if the sinuses be fistulous, there is no expectation of cure without dilation. There are also a great many scrophulous abscesses of the neck, that sometimes communicate by sinuses running under large indurations; in which instances, counter-openings are adviseable, and generally answer without the necessity of dilating the whole length; and indeed there are few abscesses in this distemper, which should be opened beyond the thinness of the skin. When abscesses of the joints discharge themselves, there is no other method of treating the fistula, but by keeping it open with the cautions already laid down, till the cartilages of the extremities of the bones being corroded, the two bones shoot into one another, and form an anchylosis of the joint, which is the most usual cure of ulcers in that part.

Gun-shot wounds often become sinuous ulcers, and then are to be considered in the same light as those already described: though surgeons have been always inclined to conceive there is something more mysterious in these wounds than any others: but their terribleness is owing to the violent contusion and laceration of the parts, and often to the admission of extraneous bodies into them, as the bullet, splinters, clothes, &c. and were any other force to do the same thing, the effect would be exactly the same as when done by fire-arms. The treatment of these wounds consists in removing the extraneous body as soon as possible; to which end the patient must be put into the same posture as when he received the wound: if it cannot be extracted by cutting upon it, which should always be practised when the situation of the blood-vessels, &c. does not forbid, it must be left to nature to work out, and the wound dressed superficially; for we must not expect, that if it be kept open with tents, the bullet, &c. will return that way; and there is hardly any case where tents are more pernicious than here, because of the violent tension and disposition to gangrene which presently ensue. To guard against mortification in this, and all other violently confused wounds, it will be proper to bleed the patient immediately, and soon after give a clyster; the part should be dressed with soft digestives, and the compress and roller applied very loose, being first dipt in brandy or spirits of wine. The next time the wound is opened, if it be dangerous, the spirituous fomentation may be employed, and after that continued till the danger is over. If a mortification comes on, the applications for that disorder must be used. In gun-shot wounds, it seldom happens that there is any effusion of blood, unless a large vessel be torn; but the bullet makes an eschar, which usually separates in a few days, and is followed with a plentiful discharge; but when the wound is

come to this period, it is manageable by the rules already laid down.

When an ulcer with loose rotten flesh discharges more than the size of it should yield, and the discharge is oily and stinking, in all probability the bone is carious; which may easily be distinguished by running the probe through the flesh: and if so, it is called a carious ulcer. The cure of these ulcers depends principally upon the removal of the rotten part of the bone, without which it will be impossible to heal, as we see sometimes even in little sores of the lower jaw, which taking their rise from a rotten tooth, will not admit of cure till the tooth be drawn. Those caries which happen from the matter of abscesses lying too long upon the bone, are most likely to recover: those of the pox very often do well, because that distemper fixes ordinarily upon the middle and outside of the densest bones, which admit of exfoliation; but those produced by the evil, where the whole extremities of spongy parts of the bone are affected, are exceedingly dangerous, though all enlarged bones be not necessarily carious; and there are ulcers sometimes on the skin that covers them, which do not communicate with the bone, and consequently do well without exfoliation: nay, it sometimes happens, though the case be rare, that, in young subjects particularly, the bones will be carious to such a degree, as to admit a probe almost thro' the whole substance of them, and yet afterwards admit of a cure, without any notable exfoliation.

The method of treating an ulcer with a caries, is by applying a caustick of the size of the scale of the bone that is to be exfoliated, and after having laid it bare, to wait till such time as the carious part can, without violence, be separated, and then heal the wound. In order to quicken the exfoliation, there have been several applications devised; but that which has been most used in all ages, is the actual cautery, with which surgeons burn the naked bone every day, or every other day, to dry up, as they say, the moisture, and by that means procure the separation: but as this practice is never of great service, and always cruel and painful, it is now pretty much exploded. Indeed, from considering the appearance of a wound, when a scale of bone is taken out of it, there is hardly any question to be made, but that burning retards rather than hastens the separation; for as every scale of a carious bone is slung off by new flesh generated between it and the sound bone, whatever would prevent the growth of these granulations, would also in a degree prevent the exfoliation; which must certainly be the effect of a red hot iron applied so close to it; though the circumstances of carious bones, and their disposition to separate, are so different from one another, that it is hardly to be gathered from experience, whether they will sooner exfoliate with or without the assistance of fire. For sometimes, in both methods, an exfoliation is not procured in a twelve month, and at other times it happens in three weeks or a month; however, if it be only uncertain whether the actual cautery be beneficial or not, the cruelty that attends the use of it should entirely banish it out of practice. It is often likewise, in these cases, employed to keep down the fungous lips that spread upon the bone; but it is much more painful than the escharotick medicine; though there will be no need of either, if a regular compress be kept on the dressings; or at worst, if a flat piece of the prepared sponge, of the size of the ulcer, be rolled on with a tight bandage, it will swell on every side, and dilate the ulcer without any pain.

Some caries of the bones are so very shallow, that they crumble insensibly away, and the wound fills up; but when the bone will neither exfoliate nor admit of granulations, it will be proper to scrape it with a ruginé, or perforate it in many points with a convenient instrument down to the quick. In the evil, the bones of the *carpus* and *tarfus* are often affected, but their sponginess is the reason that they are seldom cured: so that when these, or indeed the extremities of any of the bones, are carious through their substance, it is advisable to amputate; though there are instances in the evil, but more especially in critical abscesses, where after long dressing down, the splinters, and sometimes the whole substance of the small bones, have worked away, and a healthy habit of body coming on, the ulcer has healed; but these are so rare, that no great dependence is to be laid on such an event. The dressings of carious bones, if they are stinking, may be doctored with the tincture of myrrh; otherwise those of dry lint are easiest, and keep down the edges of the ulcer better than any other gentle applications.

Burns are generally esteemed a distinct kind of ulcers, and have been treated with a greater variety of applications than any other species of sore.

When burns are very superficial, not raising suddenly any velleation, spirits of wine are said to be the quickest relief; but whether they be more serviceable than embrocations with linseed oil, is uncertain, though they are used very much by some persons whose trade subjects them often to this misfortune. If the burn excoriates, it is easiest to roll the part up gently with bandages dipped in sweet oil, or a mixture of *unguent flor sambu.* with the oil: when the excoriations are very tender, dropping warm milk upon them every dressing is very comfortable; or if the patient can bear to have flannels wrung out of it, applied hot, it may be still better: if the burn have formed eschars, they may be dressed with *basilicon*, though generally oil alone is easier; and in these sores, whatever is the easiest medicine will be the best digestive. There is great care necessary to keep down the *fungus* of burns, and heal the wounds smooth: to which end, the edges should be dressed with lint dipped in *aqua virrid.* and dried afterwards; or they may be touched with the vitriol stone, and the dressings be repeated twice a day. There is also a greater danger of contractions from burns after the cure, than from other wounds; to obviate which, embrocations of neats-foot oil, and bandage with pasteboards, to keep the part extended, are absolutely necessary, where they can be applied.

#### EXPLANATION of Plate CLVII. fig. I.

*A.* A director by which to guide the knife in the opening of abscesses that are burst or themselves, or first punctured with a lancet. This instrument should be made either of steel, silver, or iron; but so tempered, that it may be bent and accommodated to the direction of the cavity. It is usually made quite straight; but that form prevents the operator from holding it firmly while he is cutting. The manner of using it is, by passing the thumb through the ring, and supporting it with the fore-finger, while the straight-edged knife is to slide along the groove with its edge upwards, towards the extremity of the abscess.

*B.* The straight-edged knife, proper for opening abscesses with the assistance of a director; but which, in few other respects, is preferable to the round-edged knife.

*C.* A crooked needle, with its convex and concave sides sharp:

Sharp: this is used only in the suture of the tendon, and is made thin, that but few of the fibres of so slender a body as a tendon may be injured in the passing of it. This needle is large enough for stitching the *tendo Achillis*.

D, The largest crooked needle necessary for the tying of any vessels, and should be used with a ligature of the size it is threaded with in taking up the spermatick vessels in castration, or the femoral and humeral arteries in amputation. This needle may also be used in sewing up deep wounds.

E, A crooked needle and ligature of the most useful size, being not much too little for the largest vessels, nor a great deal too big for the smallest; and therefore in the taking up of the greatest number of vessels in an amputation, is the proper needle to be employed. This needle also is of a convenient size for sewing up most wounds.

F, A small crooked needle and ligature for taking up the lesser arteries, such as those of the scalp, and those of the skin that are wounded in opening abscesses.

Great care should be taken by the makers of these needles, to give them a due temper: for if they are too soft the force sometimes exerted to carry them through the flesh, will bend them; if they are too brittle, they snap; both which accidents may happen to be terrible inconveniences, if the surgeon be not provided with a sufficient number of them. It is of great importance also to give them the form of part of a circle, which makes them pass much more readily round any vessel, than if they were made partly of a circle, and partly of a straight line, and in taking up vessels at the bottom of a deep wound, is absolutely necessary, it being impracticable to turn the needle with a straight handle, and bring it round the vessel when in that situation. The convex surface of the needle is flat, and its two edges are sharp. Its concave side is composed of two surfaces, rising from the edges of the needle, and meeting in a ridge or eminence, so that the needle has three sides. The best materials for making ligatures, are the flaxen thread that shoemakers use; which is sufficiently strong when four, six, or eight of the threads are twisted together and waxed; and is not so apt to cut the vessels, as threads that are more finely spun.

G, A straight needle, such as glovers use, with a three-edged point, useful in the uninterrupted suture, in the suture of tendons, where the crooked one C, is not preferred, and in sewing up dead bodies, and is rather more handy for taking up the vessels of the scalp.

#### Of Sutures.

WHEN a wound is recent, and the parts of it are divided by a sharp instrument, without any farther violence, and in such a manner that they may be made to approach each other, by being returned with the hands, they will, if held in close contact for some time, re-unite by inosculation, and cement like one branch of a tree ingrafted on another. To maintain them in this situation, several sorts of sutures have been invented, and formerly practised; but the number of them has of late been very much reduced. Those now chiefly described, are the interrupted, the glover's, the quilled, the twisted, and the dry sutures; but the interrupted and twisted, are almost the only useful ones; for the quilled suture is never preferable to the interrupted; the dry suture is ridiculous in terms, since it is only a piece of plaister applied in many different ways to re-unite the lips of a wound; and the glover's, or uninterrupted stitch,

which is advised in superficial wounds, to prevent the deformity of a scar, does rather, by the frequency of the stitches, occasion it, and is therefore to be rejected in favour of a compress and sticking plaister; the only instance where it should be used, is in a wound of the intestine.

Wounds are not fit subjects for suture, when there is either a contusion, laceration, loss of substance, great inflammation, difficulty of bringing the lips into apposition, or some extraneous body introduced into them; though sometimes a lacerated wound may be assisted with one or two stitches. It has formerly been forbidden to sew up wounds of the head; but this precaution is very little regarded by the moderns.

If we stitch up a wound that has none of these obstacles, we always employ the interrupted suture, passing the needle two, three, or four times, in proportion to the length of it, though there can seldom be more than three stitches required.

The method of doing it is this: the wound being emptied of the grumous blood, and your assistant having brought the lips of it together, that they may lie quite even; you carefully carry your needle from without, inwards to the bottom, and so on from within, outwards; using the caution of making the puncture far enough from the edge of the wound, which will not only facilitate the passing the ligature, but will also prevent it from eating through the skin and flesh; this distance may be three or four tenths of an inch: as many more stitches as you shall make, will be only repetitions of the same process. The threads being all passed, you begin tying them in the middle of the wound, though, if the lips are held carefully together all the while, as they should be, it will be of no great consequence which is done first. The most useful kind of knot in large wounds, is a single one first; over this, a little linen compress, on which is to be made another single knot; and then a slip-knot, which may be loosened upon any inflammation: but in small wounds, there is no danger from the double knot alone, without any compress to tie it upon; and this is most generally practised. If a violent inflammation should succeed, loosening the ligature only will not suffice; it must be cut through and drawn away, and the wound be treated afterwards without any suture. When the wound is small, the less it is disturbed by dressing, the better; but in large ones, there will sometimes be a considerable discharge, and if the threads be not cautiously carried through the bottom of it, abscesses will frequently ensue from the matter being pent up underneath, and not finding issue. If no accident happen, you must, after the lips are firmly agglutinated, take away the ligatures, and dress the orifices which they leave.

It must be remembered, that during the cure, the suture must be always assisted by the application of bandage, if possible, which is frequently of the greatest importance; and that sort of bandage with two heads, and a slit in the middle, which is by much the best, will in most cases be found practicable.

The twisted suture being principally employed in the hare-lip, we shall reserve its description for the section on that head.

#### Of the Suture of Tendons.

WOUNDS of the tendons are not only known to heal again, but even to admit of sewing up like those of the fleshy parts,

parts, though they do not re-unite in so short a time. When a tendon is partly divided, it is generally attended with an excessive pain, inflammation, &c. in consequence of the remaining fibres being stretched and forced by the action of the muscle, which necessarily will contract more when some of its resistance is taken away. To obviate this mischief, it has been hitherto an indispensible maxim in surgery, to cut the tendon quite through, and immediately afterwards perform the future. But this practice is not advisable; for though the division of the tendon afford present ease, yet the mere flexion of the joint will have the same effect, if, for example, it be a wound of a flexor tendon: besides, in order to sew up the extremities of the tendon when divided, we are obliged to put the limb in such a situation, that they may be brought into contact, and even to sustain it in that posture to the finishing of the cure: if then, the posture will lay the tendon in this position, we can likewise keep it so without using the future, and are more sure of its not slipping away, which sometimes happens from any careless motion of the joint, when the stitches have almost worn through the lips of the wound; on which account, it is by all means advisable, in this case, to forbear the future, and only to favour the situation of the extremities of the tendon, by placing the limb properly.

But when the tendon is quite separated, and the ends are withdrawn from one another, having brought them together with your fingers, you may sew them with a straight triangular pointed needle, passing it from without inwards, and from within outwards in small tendons; about three tenths of an inch from their extremities, and in the *tendo Achillis* half an inch.

As the wound of the skin will be nearly transverse, it should not be raised to expose more of the tendon, but rather sewed up with it, which will conduce to the strength of the future. The knot of the ligature is to be made as in other wounds, and the dressings are to be the same: there is a sort of thin crooked needle that cuts on its concave and convex sides, which is very handy in the future of large tendons, and to be preferred to the straight one. During the cure, the dressings must be superficial, and the parts kept steady with pasteboard and bandage: the small tendons re-unite in three weeks, but the *tendo Achillis* requires six at least.

#### Of the GASTROGRAPHY.

THIS word signifies no more than sewing up any wound of the belly; yet in common acceptation, it implies that the wound of the belly is complicated with another of the intestine. Now the symptoms laid down for distinguishing when the intestine is wounded, do not with any certainty determine it to be wounded only in one place; which want of information makes it absurd to open the abdomen in order to come at it: if so, the operation of stitching the bowels can only take place where they fall out of the abdomen, and we can see where the wound is, or how many wounds there are: if it happens that the intestines fall out unwounded, the business of the surgeon is to return them immediately, without waiting for spirituous or emollient fomentations; and in case they puff up so as to prevent their reduction by the same orifice, you may with a knife or probe-scissors sufficiently dilate it for that purpose, or even prick them to let out the wind.

Upon the supposition of the intestine being wounded in

such a manner as to require the operation, (for in small punctures it is not necessary,) the method of doing it may be this: Taking a straight needle with a small thread, you lay hold of the bowel with your left hand, and sew up the wound by the glover's stitch, that is, by passing the needle through the lips of the wound, from within outwards all the way, so as to leave a length of thread at both ends, which are to hang out of the incision of the abdomen; then carefully making the interrupted future of the external wound, you pull the bowel by the small threads into contact with the peritonæum, in order to procure an adhesion, and tie them upon a small bolster of linen. In about six days, it is said the ligature of the intestine will be loose enough to be cut and drawn away, which must be done without great force; in the interim, the wound is to be treated with superficial dressings, and the patient to be kept very still and low.

#### Of the BUBONOCELE.

WHEN the intestine or omentum falls out of the abdomen into any part, the tumour in general is known by the name of *hernia*; which is farther specified either from the difference of situation, or the nature of its contents. When the intestine or omentum falls through the navel, it is called a *hernia umbilicalis*, or *exomphalos*; when through the rings of the abdominal muscles into the groin, *hernia inguinalis*; or if into the scrotum, *scrotalis*: these two last, though the first only is properly so called, are known by the name of bubonocèle. When they fall under the *ligamentum Fallopii*, through the same passage that the iliac vessels creep into the thigh, it is called *hernia femoralis*. The bubonocèle is also sometimes accompanied with a descent of the bladder: however, the case is very rare; but when it occurs, it is known by the patient's inability to urinate, till the hernia of the bladder is reduced within the pelvis. With regard to the contents characterising the swelling, it is thus distinguished: if the intestine only is fallen, it becomes an *enterocèle*; if the omentum, (*epiploon*) *epiplocèle*; and if both, *entero-epiplocèle*. There is, besides these, another kind of hernia mentioned and described by the moderns, when the intestine or omentum is insinuated between the interstices of the muscles, in different parts of the belly: this hernia has derived its name from the place affected, and is called the *hernia ventralis*; and lastly, there have been a few instances, where the intestines or omentum have fallen thro' the great foramen of the ischium into the internal part of the thigh, between and under the two anterior heads of the triceps muscle.

All the kinds of hernias of the intestines and omentum, are owing to a preternatural dilatation of the particular orifices through which they pass, and not to a laceration of them.

The rupture of the groin, or scrotum, is the most common species of hernia, and in young children is very frequent; but it rarely happens in infancy, that any mischiefs arise from it. For the most part, the intestine returns of itself into the cavity of the abdomen, whenever the person lies down; at least a small degree of compression will make it. To secure the intestine when returned into its proper place, there are steel trusses now so artfully made, that by being accommodated exactly to the part, they perform the office of a bolster, without galling, or even sitting uneasy on the patient. These instruments are of so great service, that

were people who are subje& to ruptures always to wear them, very few would die of this dilemma: since it often appears, upon inquiry, when we perform the operation for the bubonocle, that the necessity of the operation is owing to the neglect of wearing a truss.

In the application of a truss to these kinds of swellings, a great deal of judgment is sometimes necessary, and for want of it, we daily see trusses put even on buboes, indurated testicles, hydroeles, &c.

If there is a rupture of the intestine only, it is easily, when returned into the abdomen, supported by an instrument: but if of the omentum, notwithstanding it may be returned, yet the reduction seldom brings relief, unless there is only a small quantity of it; for the omentum will lie uneasy in a lump at the bottom of the belly, and, upon removal of the instrument, drop down again immediately; upon which account, seeing the little danger and pain there is in this kind of hernia, nothing need be used but a bag truss, to suspend the scrotum, and prevent possibly by that means the increase of the tumour. The difference of these tumours will be distinguished by the feel; that of the omentum feeling flaccid and rumpled, the other more even, flatulent, and springy.

Sometimes, in a rupture of both the intestine and omentum, the gut may be reduced, but the omentum will still remain in the scrotum; and when thus circumstanced, a steel-truss must be used.

We have hitherto considered the rupture as moveable; but it happens frequently, that the intestine, after it has passed the rings of the muscles, is presently inflamed, which enlarging the tumour, prevents the return of it into the abdomen, and becoming every moment more and more strangled, it soon tends to a mortification, unless we dilate the passages through which it is fallen, with some instrument, to make room for its return; which dilatation is the operation for the Bubonocle.

It rarely happens that patients submit to this incision before the gut is mortified, and it is too late to do service; not but that there are instances of people surviving small gangrenes, and even perfectly recovering afterwards.

In mortifications of the bowels, when fallen out of the abdomen into the navel, it is not very uncommon for the whole gangrened intestine to separate from the sound one, so that the excrement must necessarily ever after be discharged at that orifice: there are likewise a few instances, where the rupture of the scrotum has mortified, and become the anus, the patient doing well in every other respect.

Before the performance of the operation for the bubonocle, which is only to be done in the extremity of danger, the milder methods are to be tried; these are, such as will conduce to soothe the inflammation.

Perhaps except the pleurisy, no disorder is more immediately relieved by plentiful bleeding than this. Clysters repeated, one after another, three or four times, if the first or second are either retained too long, or immediately returned, prove very efficacious: these are serviceable, not only as they empty the great intestines of their excrements and flatulencies, which last are very dangerous, but they likewise prove a comfortable fomentation, by passing thro' the colon all around the abdomen. The scrotum and groin must, during the stay of the clyster, be bathed with warm cloths wrung out of a fomentation; and after the part has been well fomented, you must attempt to reduce the rup-

ture: first this purpose, let your patient be laid on his back, so that his buttocks may be considerably above his head; the bowels will then retire towards the diaphragm, and give way to those which are to be pushed in. If, after endeavouring two or three minutes, you do not find success, you may still repeat the trial.

If, notwithstanding these means, the patient continues in very great torture, though not so bad as to threaten an immediate mortification, we must apply some sort of poultice to the scrotum; such as equal parts of oil and vinegar made into a proper consilience with oat-meal: after some few hours, the fomentation is to be repeated, and the other directions put in practice.

After all, should the pain and tenderness of the part continue, and hiccoughs and vomitings of the excrements succeed, the operation must take place; for if you wait until a languid pulse, cold sweats, subsiding of the tumour, and emphysematous feel come on, it will be most likely too late, as they are pretty sure symptoms of a mortification.

To conceive rightly of the occurrences in this operation, it must be remembered, that in every species of rupture, a portion of the *peritoneum* generally falls down with whatever makes the *hernia*; which, from the circumstance of containing immediately the contents of the tumour, is called the *sac* of the *hernia*. Now, the portion of the *peritoneum*, which usually yields to the impulsion of the descending viscera, is that which corresponds with the inmost opening of the abdominal muscles, just where the *membrana cellularis peritonæi* begins to form the *tunica vaginalis* of the spermatic cord; so that the *sac* with the viscera insinuate themselves into the *tunica vaginalis* of the spermatic cord, and lie upon the *tunica vaginalis* of the testicle: nevertheless, upon examination, the contents of the *hernia* are sometimes in contact with the testicle itself; that is to say, within the *tunica vaginalis* of the testicle. For some months during gestation, the *testes* of the *fœtus* remain in the abdomen; and when they descend into the *tunica vaginalis*, there is an immediate communication betwixt the cavity of the abdomen, and the cavity of the *tunica vaginalis*, which, in process of time, becomes obliterated by the coalition of the *tunicæ* with the cord; but if it happen, before the coalition be effected, that the intestine or the omentum fall into the scrotum, they will necessarily remain in contact with the *testes*.

From this description of the descent of the viscera, it is evident that the *herniary sac* is contained within the *tunica vaginalis*, and ought to give the idea of one bag inclosing another: but in the operation, this distinction of coats does not always appear; for the *herniary sac* sometimes adheres so firmly to the *tunica vaginalis*, that together they make one thick coat: this adhesion may possibly result from the present inflammation of the parts, which has rendered the operation necessary.

The best way of laying your patient will be on a table about three feet four inches high, letting his legs hang down; then properly securing him, you begin your incision above the rings of the muscles, beyond the extremity of the tumour, and bring it down about half the length of the scrotum, through the *membrana adiposa*, which will require very little trouble to separate from the *tunica vaginalis*, and consequently will expose the rupture for the farther processes of the operation. If a large vessel is opened by the incision, it must be taken up before you proceed further.

When

When the *tunica vaginalis* is laid bare, you must cut carefully through it and the *peritonæum*, in order to avoid pricking the intestines.

The *peritonæum* being cut through, we arrive to its contents, the nature of which will determine the next process: for if it is intestine only, it must directly be reduced, but if there is any mortified *omentum*, it must be cut off; in order to which it is advised to make a ligature above the part wounded, to prevent an hæmorrhage; but it is quite needless, and in some measure pernicious, as it puckers up the intestine, and disorders its situation, if made close to it.

When the *omentum* is removed, we next dilate the wound; to do which with safety, an infinite number of instruments have been invented: but there is none we can use in this case with so good management as a knife; and the finger in this operation is often a much better defence against pricking the bowels, than a director. The knife must be a little crooked and blunt at its extremity, like the end of a probe. Some surgeons perhaps may not be steady enough to cut dexterously with a knife, and may therefore perform the incision with probe-fossars carefully introducing one blade between the intestine and circumference of the rings, and dilating upwards, and a little obliquely outwards. When the finger and knife only are employed, the manner of doing the operation will be by pressing the gut down with the fore-finger, and carrying the knife between it and the muscles, so as to dilate upwards about an inch, which will be a wound generally large enough: but if, upon examination, it shall appear that the intestine is strangulated within the *abdomen*, which may possibly happen from a contraction of the *peritonæum* near the entrance into the *scæ*; in that case, the incision must be continued through the length of the contracted channel, or the consequence will be fatal, notwithstanding the intestine be restored into the *scrotum*: on this account the operator should pass his finger up the *scæ* into the *abdomen*, after the reduction of the gut, in order to discover whether it be safely returned into its proper place.

The opening being made, the intestine is gradually to be pushed into the *abdomen*, and the wound to be stitched up; for this purpose, some advise the quilled, and others the interrupted suture, to be passed through the skin and muscles; but as there is not so much danger of the bowels falling out when a dressing and bandage are applied, and the patient all the while kept upon his back, but that it may be prevented by one or two slight stitches through the skin only, it is by all means advisable to follow this method, since the stricture of a ligature in these tendinous parts may be dangerous.

Hitherto, in the description of the *bubonocèle*, we have supposed the contents to be loose, or separate in the *scæ*: but it happens sometimes in an operation, that we find not only an adhesion of the outside of the *peritonæum* to the *tunica vaginalis*, and spermatic vessel, but likewise of some part of the intestines to its internal surface; and in this case there is so much confusion, that the operator is often obliged to excise the vessel, in order to dissect away and disentangle the gut; though if it can be done without castration, it ought: however, this accident happens rarely except in those ruptures that have been a long time in the *scrotum* without returning: in which case the difficulty and hazard of the operation are so great, that, unless urged by the symptoms of an inflamed intestine, it should not be undertaken.

The dressing of the wound first of all may be with dry lint, and afterwards as directed under the head of wounds.

The operation of the *bubonocèle* in women so nearly resembles that performed on men, that it requires no particular description: only in them the rupture is formed by the intestine or *omentum* falling down through the passage of the *ligamentum rotundum* into the groin, or one of the *labia pudendi*; where causing the same symptoms, as when obstructed in the *scrotum*, it is to be returned by the dilatation of that passage.

#### Of the EPIFLOCELE.

THERE have been a few instances where so great a quantity of the *omentum* has fallen into the *scrotum*, that, by drawing the stomach and bowels downwards, it has excited vomitings, inflammation, and the same train of symptoms as happen in a *bubonocèle*; in which case, the operation of opening of the *scrotum* is necessary: the incision must be made in the manner of that for the rupture of the intestine, and the same rules observed with regard to the *omentum* that are laid down in the last section. It is necessary also, the rings of the muscles should be dilated; or otherwise, though you have taken away some of the mortified part of the *omentum*, the rest that is out of its place, and strangled in the perforation, will gangrene *à l'o*. The wound is to be treated in the same manner as that after the operation of the *bubonocèle*.

#### Of the HERNIA FEMORALIS.

THIS species of rupture is the same in both sexes, and formed by the falling of the *omentum* or intestine, or both of them, into the inside of the thigh, through the arch made by the *os pubis* and *ligamentum Fallopii*, where the iliac vessels and tendons of the *psæas* and *itracus internus* muscles pass from the *abdomen*. It is very necessary surgeons should be aware of the frequency of this disorder, which creates the same symptoms as other ruptures, and must first of all be treated by the same methods: the manner of operating in the reduction is here too so exactly the same, with the difference of dilating the ligament instead of the rings of the muscles, that it would be a mere repetition of the operation for the *bubonocèle* to give any description of it: only it may be observed, that the spermatic cord, as it enters into the *abdomen*, lies nearly transverse to the incision, and close in contact with the ligament; so that unless you make the dilatation obliquely outwards, instead of perpendicularly upwards, you will probably divide those vessels.

#### Of the EXOMPHALOS.

THIS rupture is owing to a protrusion of the intestine, or *omentum*, or both of them, at the navel, and rarely happens to be the subject of an operation: for though the case is common, yet most of them are gradually formed from very small beginnings; and if they do not return into the *abdomen* upon lying down, in all probability they adhere without any great inconvenience to the patient, till some time or other an inflammation falls upon the intestines, which soon brings on a mortification, and death; unless, by great chance, the mortified part separates from the sound one, leaving its extremity to perform the office of an *anus*: in this emergency, however, it is advisable to attempt the reduction, if called in at the beginning, though the universal adhesion of the *scæ* and its contents are a great obstacle to the success:

the instance in which it is most likely to answer, is, when the rupture is owing to any strain, or sudden jerk, and is attended with those disorders which follow upon the stragulation of a gut.

In this case, having tried all other means in vain, the operation is absolutely necessary; which may be thus performed: Make the incision somewhat above the tumour, on the left side of the navel, through the *membrana adiposa*; and then emptying the sac of its water, or mortified omentum, dilate the ring with the same crooked knife, conducted on your finger, as in the operation for the bubonocoele; after this, return the intestines and omentum into the abdomen, and dress the wound without making any ligature but of the skin only.

#### Of the HERNIA VENTRALIS.

THE *hernia ventralis*, which sometimes appears between the recti muscles, is very large; but that tumour which requires the operation is seldom bigger than a walnut, and is a disease not so common as to have been observed by many; but there are cases enough known, to put a surgeon upon inquiry after it. When the patient is suddenly taken with all the symptoms of a rupture, without any appearance of one in the navel, scrotum, or thigh, the manner of dilating it will be the same as that above directed in the other hernias; after the operation in this and all hernias where the intestines have been reduced, it will be convenient to wear a truss, since the cicatrix is not always firm enough in any of them to prevent a relapse.

#### EXPLANATION of Fig. 2. Plate CLVII.

A, The round-edged knife, of a convenient size for almost all operations where a knife is used: the make of it will be better understood by the figure than any other description; only it may be remarked, that the handle is made of a light wood, as indeed the handles of all instruments should be, that the resistance to the blades may be better felt by the surgeon.

B, A pair of probe-scissors, which require nothing very particular in their form, but that the lower blade should be made as small as possible, so that it is strong, and has a good edge; because, being chiefly used in fistulas *in ano*, the introduction of a thick blade into the sinus, which is generally narrow, would be very painful to the patient.

C, The crooked knife with the point blunted, used in the operation of the bubonocoele.

#### Of the HYDROCELE.

THE *hydrocele*, called also *hernia aquosa*, *hydrops scroti*, and *hydrops testis*, is a watery tumour of the scrotum; which, notwithstanding the multiplicity of distinctions used by writers, is but of two kinds, the one when the water is contained in the *tunica vaginalis*, and the other when in the *membrana cellularis scroti*. This last is almost always complicated with an anasarca; which species of dropsy is an extravasation of water lodged in the cells of the *membrana adiposa*; and when thus circumstanced, will not be difficult to be distinguished; besides that it is sufficiently characterised by the shining and softness of the skin, which gives way to the least impression, and remains pitted for some time. The penis is likewise sometimes enormously enlarged, by the insinuation of the fluids into the *membra-*

*cellularis*; all which symptoms are absolutely wanting in the dropsy of the *tunica vaginalis*.

In the dropsy of the *membrana cellularis scroti*, the puncture with the trocar is recommended by some, and little orifices made here and there with the point of a lancet by others; or a small skean of silk passed by a needle through the skin; and out again at the distance of two or three inches, to be kept in the manner of a seton, till the waters are quite drained: but the two first methods avail very little, as they open but few cells; and the last cannot be so efficacious in that respect as incisions, and will be much more apt to become troublesome, and even to gangrene.

Indeed it is not often proper to perform any operation at all upon this part, since the *membrana cellularis scroti*, being a continuation of the *membrana adiposa*, scarifications made through the skin in the small of the legs will effectually empty the scrotum: and this place ought rather to be pitched upon than the other, as being more likely to answer the purpose by reason of its dependency; however, it sometimes happens, that the waters fall in so great quantities into the scrotum, as, by distending it, to occasion great pain, and threaten a mortification: the prepuce of the penis also becomes very often excessively dilated, and so twisted, that the patient cannot void his urine. In these two instances, an incision of three inches long should be made on each side of the scrotum, quite through the skin into the cells containing the water, and two or three of half an inch long, in any part of the penis, with a lancet or knife; all which may be done with great safety, and sometimes with the success of carrying off the disease of the whole body.

The dropsy of the *tunica vaginalis* is owing to a preternatural discharge of that which is continually separating in a small quantity, on the internal surface of the tunick, for the moistening or lubricating the testicle, and which collecting too fast accumulates and forms in time a swelling of great magnitude: this is what we take to be the other species of hydrocele, and the only one besides.

The hydrocele of the *tunica vaginalis* is very easily to be distinguished from the hydrocele of the *membrana cellularis*, by the preceding description of that species of dropsy: We shall now explain how it differs from the other tumours of the scrotum, *viz.* the *bubonocoele*, *epiplocele*, and enlarged testicles. In the first place, it is seldom or never attended with pain in the beginning, and is very rarely to be imputed to any accident, as the hernia's of the omentum and intestine are. From the time it first makes its appearance, it very seldom is known to appear or diminish; but generally continues to increase, though in some much faster than in others; in one person growing to a very painful distension in a few months, whilst in another it shall not be troublesome in many years; nay, shall cease to swell at a certain period, and ever after continue in that state without any notable disadvantage; though this last case very rarely happens. In proportion as it enlarges, it becomes more tense, and then is said to be transparent: indeed the transparency is made the chief criterion of the distemper, it being constantly advised to hold a candle on one side of the scrotum, which it is said will shine through the other, if there be water. But this experiment does not always answer, because sometimes the *tunica vaginalis* is very much thickened, and sometimes the water itself is not transparent: so that to judge positively if there be a fluid, we must be guided by feeling a fluctuation; and

and though we do not perhaps evidently perceive it, yet we may be persuaded there is a fluid of some kind, if we are once assured that the distension of the *tunica vaginalis* makes the tumour; which is to be distinguished in the following manner.

If the the intestine, or omentum, form the swelling, they will be soft and pliable, (unless inflamed;) uneven in their surface, particularly the omentum; and both of them extend themselves up from the scrotum quite into the very abdomen: whereas, in the hydrocele, the tumour is tense and smooth, and ceases before or at its arrival to the rings of the abdominal muscles; because the upper extremity of the *tunica vaginalis* terminates at some distance from the surface of the belly.

When the testicle is increased in its size, the tumour is rounder; and if not attended with an enlargement of the spermatic vessels, the cord may be easily distinguished between the swelling and abdomen; but without this rule of distinction, either the pain, or the very great hardness, will discover it to be a disease of the testicle.

As to the cure of this distemper by external applications, or internal means, little is to be expected; on which account, it is generally advisable to wait with patience until the tumour becomes troublesome, and then to tap it with a lancet or trocar. In opening with a lancet, it may possibly happen, that the orifice of the skin shall slip away from that of the tunick, and prevent the egress of the water: to obviate which inconvenience, you may introduce a probe, and by that means secure the exact situation of the wound; but if the coats are very much thickened, it will be advisable to use the trocar, rather than the lancet. It is spoken of as an easy thing, to hold the testicle with the left hand, while we make the puncture with the right; but when the *tunica vaginalis* is very tense, it cannot well be distinguished: however, there is no danger of wounding it, if you make the puncture in the inferior part of the scrotum. During the evacuation, the scrotum must be regularly pressed; and after the operation, a little piece of dry lint and sticking plaster are sufficient.

This method of tapping is called the palliative cure; not but that it does now and then prove an absolute one. To prevent the relapse of this disease, surgeons prescribe the making a large wound, either by incision or caustic, that upon healing it afterwards, the firmness and contraction of the cicatrix may bind up the relaxed lymphatic vessels, and obstruct the further preternatural effusion of their contents: but this practice is generally attended with so much trouble, that, notwithstanding its success in the end, most surgeons prefer the palliative.

#### Of CASTRATION.

THIS is one of the most melancholy operations in the practice of surgery, since it seldom takes place but in disorders into which the patient is very apt to relapse, viz. those of a schirrhous, or cancer: for under most of the symptoms described as rendering it necessary, it is absolutely improper; such as a hydrocele, abscess of the testes, an increasing mortification, or what is sometimes understood by a farcocele; of which last it may not be amiss to say a word. In the utmost latitude of the meaning of this term, it is received as a fleshy swelling of the testicle itself, called likewise *hernia carnofa*; or in some enlargements, such as in a clap, more frequently *hernia humoralis*; but generally speaking, is considered as a fleshy excrescence formed on the body of the testis, which

becoming exceedingly hard and tumefied, for the most part is supposed to demand extirpation, either by cutting or burning away the induration, or amputating the testicle. But this maxim too precipitately received, has very much misguiding the practitioners of surgery.

It sometimes happens that the epididymis is tumefied, independent of the testicle; and feeling like a large adventitious excrescence, answers very well to the idea most surgeons form of a *farcocele*: but not being aware of the different nature and texture of the epididymis, they have frequently confounded its disorders with those of the testicle itself, and equally recommended extirpation in the induration of one or the other. But all indurations of the glandular part of the testicle not tending to inflammation and abscess, generally, if not always, lead on to scirrhus and cancers; whereas those of the epididymis seldom or never do. It is true, in spite of internal or external means, these last often retain their hardness, and sometimes suppurate, but however without much danger in either case.

Before castration, it is laid down as a rule to inquire whether the patient has any pain in his back, and in that case to reject the operation, upon the reasonable presumption of the spermatic vessels being likewise diseased: but we are not to be too hasty in this determination; for the mere weight of the tumour stretching the cord, will sometimes create this complaint. To learn the cause then of this pain in the back, when the spermatic cord is not thickened, let your patient be kept in bed, and suspend his scrotum in a bag-truss, which will relieve him, if disordered by the weight only; but if the spermatic cord is thickened or indurated, which disease, when attended with a dilatation of the vessels of the scrotum, is known by the Greek appellations *circocoele* and *varicocoele*, the case is desperate, and not to be undertaken.

But supposing no obstacle in the way to the operation, the method of doing it may be this: Lay your patient on a square table of about three feet four inches high, letting his legs hang down, which, as well as the rest of his body, must be held firm by the assistants. Then with a knife begin your wound above the rings of the abdominal muscles, that you may have room afterwards to tie the vessels, since for want of this caution operators will necessarily be embarrassed in making the ligature: then carrying it through the *membrana adiposa*, it must be continued downward, the length of it being in proportion to the size of the testicle. If it is very small, it may be dissected away without taking any part of the scrotum. If the testicle, for instance, weighs twenty ounces; having made one incision about five inches long, a little circularly, begin a second in the same point as the first, bringing it with an opposite sweep to meet the other in the inferior part, in such a manner as to cut out the shape of an oval whose smallest diameter shall be two inches: after this, dissect away the body of the tumour, with the piece of skin on it, from the scrotum; first taking up some of the blood-vessels, if the hæmorrhage is dangerous. Then pass a ligature round the cord, pretty near the abdomen, and if you have space between the ligature and testicle, a second about half an inch lower, to make the stoppage of blood still more secure. The ligatures may be tied with what is called the *surgeon's knot*, where the thread is passed through the ring twice. This done, cut off the testicle a little underneath the second ligature, and pass a needle from the skin at the lower part of the wound through the skin at the upper part, in such a manner as to envelope in

some degree the sound taste, which will greatly facilitate and quicken the cure; or if one stitch will not answer the purpose, you may repeat it in such part of the wound where the skin on each side lies most loose.

In large tumours, it is advisable to cut away great part of the skin; for besides that the hæmorrhage will be much less in this case, and the operation greatly shortened, the skin by the great distension having been rendered very thin, will great part of it, if not taken away, sphacelate, and the rest be more prone to degenerate into a cancerous ulcer.

#### Of the PHYMOSIS.

THE *phymosis* signifies no more than such a straitness of the prepuce, that the glans cannot be denuded; which if it becomes troublesome, so as to prevent the egress of the urine, or conceal under it chancres, or foul ulcers, quite out of the reach of application, is to be cut open. It sometimes happens, that children are born imperforate; in which case, a small puncture, dressed afterwards with a tent, effects a cure. But this operation is chiefly practised in venereal cases, in order to expose chancres either on the glans or within the prepuce itself: and here, if the prepuce is not very callous and thick, a mere incision will answer; which may be made either with the scissors, or by slipping a knife between the skin and glans to the very extremity, and cutting it up: the last method is more easy than that of the scissors; but it is safer to make the wound on the side of the prepuce than upon the upper part, for sometimes the great vessels on the *dorsum penis* afford a terrible hæmorrhage; though the prepuce remains better shaped after an incision made in the upper part, and therefore is to be preferred by those who understand how to take up the vessels. In children it sometimes happens that the prepuce becomes very much contracted; and in that case, it is accidentally subject to slight inflammations, which bring on some symptoms of the stone; but the disorder is always removed by the cure of the *phymosis*.

If the prepuce be very large and indurated, the opening alone will not suffice; and it is more advisable to take away the callosity by circumcision, which must be performed with a knife; and if the artery bleed much, it must be taken up with a small needle and ligature.

#### Of the PARAPHYMOSIS.

THE *paraphymosis* is a disease of the penis, where the prepuce is fallen back from the glans, and cannot be brought forwards to cover it. There are many whose penis is naturally thus formed, but without any inconvenience; so that since the time of the Romans, (some of whom thought it indecent to have the glans bare,) it has not been usual to perform any operation upon that account; but we read the several processes of it described very particularly by Celsus, who does not speak of it as an uncommon thing. Most of the instances of this distemper are owing to a venereal cause; but there are some where the prepuce is naturally very tight, which take their rise from a sudden retraction of it, and immediate enlargement of the glans preventing its return. Sometimes it happens that the surgeon succeeds in the reduction immediately, by compressing the extremity of the penis, at the time he is endeavouring to advance the prepuce; if he does not, let him keep it suspended, and attempt again, after having fomented, and used some emollient applications: but if, from the contraction below the

*corona glandis*, there is so great a stricture as to threaten a gangrene, or even, if the penis is much enlarged by water in the *membrana reticularis*, forming tumours called *crystallines*, three or four small incisions must be made with the point of a lancet, into the stricture and *crystallines*, according to the direction of the penis; which in the first case will set free the obstruction, and in the other evacuate the water: the manner of dressing afterwards must be with fomentations, digestives, and the *theriaca Londinensis* over the pledgits.

#### Of the PARACENTESIS.

THIS operation is an opening made into the abdomen, in order to empty any quantity of extravasated water, collected in that species of dropsy called the *ascites*; but as there is much more difficulty in learning when to perform than how to perform it, and indeed in some instances requires the nicest judgment, we shall endeavour to specify the distinctions which render the undertaking more or less proper.

There are but two kinds of dropsy: the *anasarca*, called also *leucophlegmacy*, when the extravasated water swims in the cells of the *membrana adiposa*; and the *ascites*, when the water possesses the cavity of the abdomen. In the first kind, the water is clear and limpid; but in the second, a little grosser, very often gelatinous and corrupted, and sometimes even mixed with fleshy concretions.

The operation of tapping is seldom the cure of the distemper: but dropsies, which are the consequence of a mere impoverishment of the blood, are less likely to return than those which are owing to any previous disorder of the liver; and it is not uncommon for dropsies that follow agues, hæmorrhages, and diarrhœas to do well; whereas in such as are complicated with a scirrhus liver, there is hardly an example of a cure.

The water floating in the belly, is, by its fluctuation, to determine whether the operation be advisable; for if, by laying one hand on any part of the abdomen, you cannot feel an undulation from striking on an opposite part with the other, it is to be presumed there will be some obstacle to the evacuation. It sometimes happens, that a great quantity, or almost all the water, is contained in little bladders, adhering to the liver and the surface of the *peritonæum*, known by the name of *hydatids*; and the rest of it in different sized ones, from the degree of a *hydatid*, to the size of a globe holding half a pint or a pint of water. This is called the encysted dropsy, and from the smallness of its cysts makes the operation useless; but is not difficult to be distinguished, because there is not a fluctuation of the water, unless it is complicated with an extravasation.

When the fluctuation is hardly perceptible, (except the teguments of the abdomen are very much thickened by an *anasarca*,) in all probability the fluid is gelatinous.

There is another kind of dropsy, which for the most part forbids the operation, and is peculiar to women, being seated in the body of one or both ovaries. There is no example of this species but what may be known by the hardness and irregularity of the tumour of the abdomen, which is nearly uniform in the other cases.

When the ovary is dropsical, the water is generally deposited in a great number of cells formed in the body of it; which circumstance makes the fluctuation insensible, and the perforation useless: though sometimes there are only one or

two cells; in which case, if the ovary is greatly magnified, the undulation will be readily felt, and the operation be advisable.

When the *ascites* and *anasarca* are complicated, it is seldom proper to perform the operation, since the water may be much more effectually evacuated by scarifications in the legs than by tapping.

Upon the supposition nothing forbids the extraction of the water, the manner of operating is this: Having placed the patient in a chair of a convenient height, let him join his hands so as to press upon his stomach; then dipping the trocar in oil, you stab it suddenly through the teguments, and, withdrawing the perforator, leave the waters to empty by the canula: the *abdomen* being, when filled, in the circumstance of a bladder distended with a fluid, would make it indifferent where to wound; but the apprehension of hurting the liver, if it be much enlarged, has induced operators rather to chuse the left side, and generally in that part which is about three inches obliquely below the navel: if the navel protuberates, you may make a small puncture with a lancet through the skin, and the waters will be readily voided by that orifice, without any danger of a *hernia* succeeding: but it should be carefully attended to, whether the protuberance is formed by the water or an *exomphalos*; in which latter case, the intestine would be wounded, and not without the greatest danger. The surgeon neither in opening with the lancet, nor perforating with the trocar, need fear injuring the intestines, unless there is but little water in the *abdomen*, since they are too much confined by the mesentery to come within reach of danger from these instruments; but it sometimes happens that when the water is almost all emptied, it is suddenly stopped by the intestine or omentum pressing against the end of the canula; in which case you may push them away with a probe: during the evacuation, your assistants must keep pressing on each side of the *abdomen*, with a force equal to that of the waters before contained there; for by neglecting this rule, the patient will be apt to fall into faintings, from the weight on the great vessels of the *abdomen* being taken off and the sinking of the diaphragm succeeding; in consequence of which, more blood flowing into the inferior vessels than usual, leaves the superior ones of a sudden too empty, and thus interrupts the regular progress of the circulation. To obviate this inconvenience, the compression must not only be made with the hands during the operation, but be afterwards continued, by swathing the *abdomen* with a roller of flannel, about eight yards long, and five inches broad, beginning at the bottom of the belly, so that the intestines may be borne up against the diaphragm: you may change the roller every day till the third or fourth day, by which time the several parts will have acquired their due tone. For the dressing a piece of dry lint and plaister suffice; but between the skin and roller it may be proper to lay a double flannel a foot square, dipt in brandy or spirits of wine.

This operation, though it does not often absolutely cure, yet it sometimes preserves life a great many years, and even a pleasant one, especially if the waters have been long collecting.

#### EXPLANATION of Fig. 3. Plate CLVII.

A, A trocar of the most convenient size for emptying the *abdomen* when the water is not gelatinous. It is here re-

presented with the perforator in the canula, just as it is placed when we perform the operation.

B, The canula of a large trocar, recommended in cases where the water is gelatinous.

C, The perforator of the large trocar.

The handle of the trocar is generally made of wood, the canula of silver, and the perforator of steel. Great care should be taken by the makers of this instrument, that the perforator should exactly fill up the cavity of the canula; for unless the extremity of the canula lies quite close and smooth on the perforator, the introduction of it into the *abdomen* will be very painful. To make it slip in more easily, the edge of the extremity of the canula should be thin and sharp; and that the canula should be of steel; for the silver one being of too soft a metal, becomes jagged or bruised at its extremity with very little use.

#### Of the FISTULA IN ANO.

The *fistula in ano* is an abscess running upon or into the *intestinum rectum*.

The piles, which are little tumours formed about the verge of the *anus*, immediately within the *membrana interna* of the *rectum*, do sometimes suppurate, and become the fore-runners of a large abscess; also external injuries here, as in every other part of the body, may produce it; but from whatever cause the abscess arise, the manner of operating upon it will be according to the nature and direction of its cavity.

If the surgeon have the first management of the abscess, and there appear an external inflammation upon one side of the buttock only; after having waited for the proper maturity, let him with a knife make an incision the whole length of it; and in all probability, even though the bladder be affected, the largeness of the wound, and the proper application of doffils lightly pressed in, will prevent the putrefaction of the intestine, and make the cavity fill up, like imposthumations of other parts.

If the *sinus* be continued to the other buttock, almost surrounding the intestine, the whole course of it must be dilated in like manner; since, in such spongy cavities, a generation of flesh cannot be procured but by large openings; whence also, if the skin is very thin, lying loose and flabby over the *sinus*, it is absolutely necessary to cut it quite away, or the patient will be apt to sink under the discharge, which, in the circumstance here described, is sometimes excessive. By this method, which cannot be too much recommended, it is amazing how happy the event is likely to be; whereas, from neglecting it, and trusting only to a narrow opening, if the discharge do not destroy the patient, at least the matter, by being confined, corrupts the gut, and insinuating itself about it, forms many other channels, which running in various directions often baffle an operator, and have been the cause of a fistula being to generally esteemed very difficult of cure.

Here we have considered the imposthumation as possessing a great part of the buttock; but it more frequently happens, that the matter points with a small extent of inflammation on the skin, and the direction of the *sinus* is even with the gut: in this case, having made a puncture, you may with a probe learn if it has penetrated into the intestine. By passing your finger up it, and feeling the probe introduced through the wound into its cavity; though, for the most part, it may

be known by a discharge of matter from the *anus*. When this is the state of the fistula, there is no hesitation to be made; but immediately putting one blade of the scissars up the gut, and the other up the wound, snip the whole length of it. This process is as adviseable when the intestine is not perforated, if the *sinus* is narrow, and runs upon or very near it; for if the abscess be tented, which is the only way of dressing it while the external orifice is small, it will almost certainly grow callous; so that the surest means of cure, will be opening the gut, that proper applications may be laid to the bottom of the wound. However, it should be well attended to, that some *sinuses* pretty near the intestine neither run into nor upon it; in which case, they must be opened, according to the course of their penetration. There are abundance of instances, where the intestine is so much ulcerated, as to give free issue to the matter of the abscess by the *anus*: but there are none where there is not, by the thinness and discolouration of the skin, or an induration to be perceived through the skin, some mark of its direction; which, if discovered, may be opened into with a lancet, and then it becomes the same case as if the matter had fairly pointed.

If the *sinuses* into and about the gut are not complicated with an induration, and you can follow their course; the mere opening with scissars, or a knife guided on a director, will sometimes suffice; but it is generally safer to cut the piece of flesh surrounded by these incisions quite away, and, when it is callous, absolutely necessary, or the callosities must be washed afterwards by escharotick medicines, which is a tedious and cruel method of cure.

When the fistula is of a long standing, and we have choice of time for opening it, a dose of rhubarb the day before the operation will be very convenient, as it not only will empty the bowels, but also prove an alstringent for a while, and prevent the mischief of removing the dressings in order to go to stool.

It sometimes happens, that the orifices are so small, as not to admit the entrance of the scissars; in which case, sponge tents must be employed for their dilatation.

In performing these operations on the *anus*, no instruments are so handy as the knife and scissars; almost all the others which have been invented to facilitate the work are not only difficult to manage, but more painful to the patient: however, in those instances where the fistula is very narrow, and opens into the intestines, just within the verge of the *anus*, the syringotomy may be used with advantage; but where the opening into the gut is high, it cannot be employed without giving great pain.

The worst species of fistula is that communicating with the *urethra*, and sometimes (through the prostate gland) with the bladder itself. This generally takes its rise from a former gonorrhoea, and appears externally first in *perineo*, and afterwards increasing more towards the *anus*, and even sometimes into the groin, bursts out in various orifices, through the skin, which soon becomes callous and rotten; and the urine passing partly through these orifices, will often excite as much pain, and of the same kind, as a stone in the bladder.

This species of fistula taking its rise from strictures of the *urethra*, is only manageable by the bougie: for so long as the *urethra* is obstructed, the cure of the fistula will be imperfect; but if the canal be opened by this application, it is amazing what obstinate indurations and foul *sinuses* will

in consequence disappear; though there are some so callous and rotten, as to demand the knife and skilful dressings, notwithstanding the *urethra* should be dilated by the use of bougies.

#### Of the Puncture of the PÆRINEUM.

THIS operation is performed, when the bladder is under such a suppression of urine, as cannot be relieved by any gentler methods, nor, by reason of the obstruction in its neck or the *urethra*, will admit of the introduction of a catheter. The manner of doing it, as described by most writers, is by pushing a common trocar from the place where the external wound in the old way of cutting is made, into the cavity of the bladder, and so procuring the issue of the water through the canula; but others, refining upon this practice, have ordered an incision to be carried on from the same part into the bladder, and then to insinuate the canula: but both the methods are to be rejected, in favour of an opening a little above the *os pubis*: for besides that it is not easy to guide the instrument through the prostate gland into the bladder, the necessity of continuing it, in a part already very much inflamed and thickened, seldom fails to do mischief, and even to produce a mortification.

There is another method still more easy both to the patient and the operator; which consists only in emptying the bladder with a common trocar, and stopping the canula with a little cork, which is afterwards to be taken out as often as the patient has occasion to urinate. The canula is to be continued in the bladder, till such time as the person finds he can void his urine by the natural passage.

In this operation the *abdomen* ought to be perforated about two inches above the *os pubis*; and if the patient be fat, the trocar should penetrate two inches, otherwise an inch and a half will be sufficient.

#### Of the STONE.

STONY concretions are a disease incident to several parts of the body; but we shall treat only of those formed in the kidneys and bladder.

Small stones and gravel are frequently voided without pain; but sometimes they collect and become very large in the kidneys; in which case, a fit of the stone in that part is the cure, from the inflammation and pain occasioning convulsive twitches, which at last expel them. But in this disease the patient is very much relieved by several kinds of remedies, such as the mucilaginous, the saponaceous, &c. some of which lubricate, and others both lubricate and stimulate. The sand, in passing through the *ureters*, is very much forwarded by the force of the urine. The *ureters* being very narrow as they run over the *psoas* muscle, and also at their entrance into the bladder, make the movement of the stone very painful and difficult in those parts; but there is seldom so much trouble after the first fit; for when once they have been dilated, they generally continue so. For the symptoms of a stone in the bladder, see MEDICINE, p. 122.

#### Of SEARCHING.

THE patient being laid on a horizontal table, with his thighs elevated and a little extended, pass the sound with the concave part towards you, until it meets with some resistance in *perineo*, a little above the anus; then turning it without much force, push it gently on into the bladder; and

if it meets with an obstruction at the neck, raise its extremity upwards, by inclining the handle of it towards you; or if it don't then slip in, withdraw it a quarter of an inch, and introducing your fore finger into the *rectum*, lift it up, and it will seldom fail to enter: there is some art in turning the sound in the proper place of the *urethra*; which surgeons not versed in this operation cannot so well execute; therefore they may pass the instrument with the concave side always towards the *abdomen* of the patient, observing the same rule at the entrance into the bladder as in the other method. The cause of this obstacle, besides the *rugæ* of the *urethra*, and the resistance of the *verumontanum*, is sometimes a small projection of the orifice of the bladder, in the *urethra*, like that of the *os tinctæ* in the *vagina*, which occasions the end of the sound to slip a little beyond it.

Though, upon searching, we are assured of a stone in the bladder, we are not, without further inquiry, to operate immediately; since there are sometimes obstacles which forbid the operation, either absolutely, or only for a certain time; among these, that of greatest consequence, is the gravel or stone in the kidneys. The objections of less weight, and which frequently are removed, are a fit of the stone, a cough, a hectic, and being emaciated by long pain; excessive hot or cold weather are likewise hindrances: But in extremity of danger, these last considerations may be disregarded.

Difference of age makes an extreme difference of danger, infants and young people almost always recovering; but still the operation is adviseable on those advanced in years, tho' it is not attended with near the same success. This operation is performed four several ways, all which we shall describe.

#### *Of the LESSER APPARATUS, or Cutting on the GRIPE.*

THE most ancient way of cutting for the stone, is that described by *Celsus*, and known by the name of *cutting on the gripe*; though, since the time of *Johannes de Romanis*, it is also called *cutting with the lesser apparatus*, to distinguish it from his new method, which, on account of the many instruments employed in it, is called *cutting with the greater apparatus*. The manner of doing the operation is this: You first introduce the fore finger and middle finger of the left hand, dipt in oil, up the *anus*, and pressing softly with your right hand above the *os pubis*, endeavour to bring the stone towards the neck of the bladder; then making an incision, on the left side of the *perineum*, above the *anus*, directly upon the stone, you turn it out through the wound, either with your fingers or a scoop.

This way of cutting was attended with many difficulties, for want of proper instruments to direct the incision, and extract the stone, when it lay beyond the reach of the fingers, which in a large bladder was frequently the case.

The wound of the bladder in this operation is made in the same place as is now practised in the lateral method; but it being impracticable on some subjects, and uncertain on all others, has made it universally exploded.

#### *Of the GREATER APPARATUS, or the Old way.*

THIS method of cutting, invented by *Johannes de Romanis*, has at different times, and with different people, varied considerably in some of its processes, and particularly with regard to the use of certain instruments. What we shall

describe, will be the manner in which it is now practised with all its improvements.

Having laid the patient on a square horizontal table, three feet four inches high, with a pillow under his head, let his legs and thighs be bent, and his heels made to approach his buttocks, by tying his hands to the bottom of his feet, with a couple of strong ligatures, about two yards long; and to secure him more effectually from struggling, pass a double ligature under one of his hams, and carry the four strings round his neck to the other ham; then passing the loop underneath it, make a knot by threading one of the single ends through the loop: After this, the thighs being widened from each other, and firmly supported by proper persons, you introduce the staff, having first dipt it in oil, which must be held by your assistant, a little leaning on the left side of the seam in *perinaeo*; and beginning the external wound just below the *scrotum*, (which must be held out of the way.) you continue it downwards, to within two fingers breadth of the *anus*; then leaving that direction, you slip the knife forwards in the groove, pretty far into the bulbous part of the *urethra*; or, as there is some danger of wounding the *rectum*, in the continuation of the incision, you may turn the knife with the back towards it, and make this part of the incision from within outwards. Should a very large vessel be cut, it will be adviseable to tie it before you proceed any farther in the operation. When the wound is made, slide the gorget along the groove of the staff into the bladder; and to do it with more safety, when the beak of it is received in the groove, it will be proper to take the staff yourself in your hand: for if the assistant should, unwarily, either incline the handle of it too much towards you, or not resist enough to the force of the gorget, it is very apt to slip out of the groove, between the *rectum* and the bladder; which accident is not only inconvenient to the operator for the present, but is attended for the most part with very bad consequences. The gorget being passed, dilate the *urethra* and neck of the bladder with your fore-finger, and introduce the forceps into the bladder, keeping them shut till you touch the stone, when you must grasp it with a moderate force, and extract it by pulling downwards towards the *rectum*. Should you find a difficulty in laying hold of the stone, be careful to keep your forceps in such a position, that they may open upwards and downwards, (not laterally,) which will very much facilitate the embracing of the stone, in case it should happen to be thin and flat.

#### *Of the HIGH OPERATION.*

THIS method of cutting for the stone was first published in the year 1561, by *Pierre Franco*. About the year 1719, it was first done in *England* by Mr *Douglas*, and after him practised by others. The manner of performing it, with the improvements made since *Franco's* operation, is this:

The patient being laid on a square table, with his legs hanging over, and fastened to the sides of it by a ligature passed above the knee; his head and body lifted up a little by pillows, so as to relax the abdominal muscles; and his hands held steady by some assistants; insert through a catheter into the bladder as much barley-water as he can bear, which in a man is often about eight ounces, and sometimes, twelve. For the more easily doing this, an ox's *ureter* may be tied to the extremity of the syringe; and handle of the

catheter,

catheter, which being pliable will prevent any painful motion of the instrument in the bladder.

The bladder being filled, an assistant, in order to prevent the reflux of the water, must grasp the *penis* the moment the catheter is withdrawn, holding it on one side, in such a manner as not to stretch the skin of the *abdomen*; then with a round edged knife make an incision about four inches long, between the *recti* and pyramidal muscles, through the *membrana adiposa*, as deep as the bladder, bringing its extremity almost down to the *penis*; after this, taking a crooked knife, continue the incision into the bladder, carrying it a little under the *os pubis*, and immediately upon the water's flowing out, introduce the fore-finger of your left hand, which will direct the forceps to the stone.

This method was at first received with great applause in London; but after some trial was rejected, for the following inconveniences.

It sometimes happens that the bladder, notwithstanding the injection. still continues so deep under the *os pubis*, that the *peritonæum* being necessarily wounded first, the intestines push out immediately at the orifice, and the urine afterwards empties into the *abdomen*; in which case, hardly any recover. The injection itself is exceedingly painful; and however slowly the fluid be injected, it distends the bladder so much more suddenly than the urine from the kidneys does, and so much faster than it can well bear, that it not only is seldom dilated enough to make the operation absolutely secure, but is sometimes even burst, or at least its tone destroyed by the hasty dilatation. What adds to the danger here, is the possibility of meeting with a contracted indurated bladder; which is a circumstance sometimes attending on the stone, and indeed an exceedingly dangerous one in all the other methods; but would be frightful in this, by reason not only of the necessity of wounding the *peritonæum*, but of the difficulty of coming at the stone. If the stone be very small, it is hard to lay hold of it with the forceps, and in a fat man the fingers are not long enough for that purpose. If there are many little stones, it will scarce happen that more than one at a time can be extracted; and if the stone breaks, it not only is impracticable to take it all away in the operation, but also, from the supine posture of the patient, it will generally remain in the bladder; whereas, in the other methods, for the most part, it works itself out with the urine. But even supposing that the operation itself is prosperous, the consequences generally are very troublesome; for the urine issuing out at an orifice where there is no descent, spreads itself upon the *abdomen*, and makes very painful excoriations; though, what is still worse, it sometimes insinuates itself into the cells between the bladder and *abdominal* muscles, and, together with the inflammation excited by the operation, brings on a suppuration there, which is always difficult to manage, and frequently mortal.

#### Of the LATERAL OPERATION.

THIS method was invented by an ecclesiastic, who called himself *Frere Jaques*. He came to Paris in the year 1697, bringing with him an abundance of certificates of his dexterity in opening; and making his history known to the court, and magistrates of the city, he got an order to cut at the *Hotel Dieu*, and the *Charité*, where he performed this operation on about fifty persons. His success did not answer the promises he had made.

The principal defect in his manner of cutting was the want of a groove in his staff; which made it difficult to carry the knife exactly into the bladder; nor did he take any care of his patients after the operation; so that for want of proper dressings, some of the wounds proved fistulous, and other ill consequences ensued.

Chefelden, improving *Frere Jaques's* method, made use of the following, which is now the practice of most operators.

The patient being laid on a table, with his hands and feet tied, and the staff passed as in the old way, let your assistant hold it a little slanting on one side, so that the direction of it may run exactly through the middle of the left *erector penis* and *accelerator urinae* muscles; then make your incision through the skin and fat, very large, beginning on one side of the seam in *perinaeo*, a little above the place wounded in the old way, and finishing a little below the anus, between it and the tuberosity of the ischium: this wound must be carried on deeper between the muscles, until the prostate be felt; when, searching for the staff, and fixing it properly, if it has slipped, you must turn the edge of the knife upwards, and cut the whole length of that gland from within outwards, at the same time pushing down the rectum with a finger or two of the left hand; by which precautions the gut will always escape wounding; after which, the operation finishes nearly in the same manner as with the greater apparatus.

If, upon introducing the forceps, you do not perceive the stone readily, you must lift up their handle, and feel almost perpendicularly for it; since for the most part, when it is hard to come at, it lies in one of the sinuses sometimes formed on each side of the neck of the bladder, which project forward in such a manner, that if the stone lie there, the forceps pass beyond it the moment they are through the wound; so that it would be impossible to lay hold of it, or even to feel it, if not aware of this circumstance.

When the stone breaks, it is much safer to take away the fragments with the forceps, than to leave them be discharged with the urine; and if the pieces are very small, like sand, a scoop is the best instrument; though some prefer the injecting barley-water into the bladder, which suddenly returning, brings away the broken particles of the stone.

As there are hardly any instances of more stones than one, when the stone taken away is rough; so when it is smooth and polished in any part of it, it is almost a certain sign of others behind; on which account, an operator should be careful, in that case, to examine not only with his fingers, but some convenient instrument, for the remaining ones; though indeed, in all cases, it may be proper to examine the bladder after the extraction of a stone; because it is possible there may be a second stone, notwithstanding the first be rough.

The great inconvenience of the lateral operation is the hæmorrhage which sometimes ensues in men; for in children the danger of it is not worth mentioning.

If in the operation any very large vessel of the external wound should be divided, it is advisable to tie it before the extraction of the stone; but the necessity of doing this, does not occur once in twenty times.

There is but one objection more of any consequence, which is the danger of wounding the rectum; and this is a very troublesome accident: But if the operator observes the rule laid down with regard to that article, it might always be avoided.

In this method the remarkable parts wounded by the knife are, the *musculus tranſverſalis penis*, *levator ani*, and *proſtate gland*: In the old way, the urethra only is wounded, about two inches on this ſide the proſtate, and the inſtruments are forced through the reſt of the paſſage, which is compoſed of the bulbous part of the urethra, the membranous part of the urethra, the neck of the bladder, and proſtate gland. This channel is ſo very narrow, that, till it be torn to pieces, the management of the forceps is exceedingly difficult; and it happens frequently, that from the tender texture of the membranous parts, the forceps are unwarily puſhed through it between the *os pubis* and bladder; beſides that in introducing the gorget upon the ſtaff, it is apt to ſlip downwards between the reſtum and bladder, both which inconveniencies are avoided in the lateral operation. It is true, the wound made in the lateral method will not admit of the extraction of a large ſtone without laceration as well as in the old way: but in the one caſe, the laceration is ſmall, and made after a preparation for it by an incision; and in the other, all the parts are torn without any previous opening, and which are ſo very tight, that the pain of the diſtenſion muſt neceſſarily be exceſſive. However, in both theſe operations, the ſurgeon muſt not graſp the ſtone with violence; and even in extracting, muſt, with both hands to the branches of his forceps, reſiſt their ſhutting ſo tight, as the compreſſion from the lips of ſuch a narrow wound would otherwiſe make them. The extraction of very large ſtones is much more impracticable with the greater apparatus than by this method, becauſe of the ſmallneſs of the angle of the bones in that part where the wound is made; ſo that indeed it is neceſſary in almoſt all extractions to pull the ſtone downward towards the reſtum, which cannot be done without great violence to the membranous parts, and even the ſeparation of one from another; whence follow abſceſſes and ſloughs about the wound, which is a circumſtance not known in the lateral operation. *Echymofes* followed by ſuppuration and gangrene, ſometimes ſpread themſelves upon the ſcrotum; and in ſhort, all the inconveniences and ill ſymptoms which attend upon the lateral operation, except the hæmorrhage, are in a more violent degree incident to the old way.

An incontinence of urine is not common after the lateral operation, and a ſiſtula ſeldom or never the conſequence of it.

The manner of treating the patient after the operation, is pretty nearly this: If it happens that the veſſels of the proſtate bleed, dry lint, or lint dipped in ſome ſtyptic water, ſuch as *aqua vitrioli*, muſt be applied to the part, and held there with a conſiderable degree of preſſure for a few hours; or a ſilver canula of three or four inches long, covered with fine rag, may be introduced into the bladder, and left there two or three days, which ſeldom fails to ſtop the hæmorrhage. The patient may alſo take an opiate. If the wound does not bleed, a little dry lint, or a pledgit of digeſtive laid gently in it, is beſt. The place where the patient lies, ſhould be moderately cool, as heat not only diſpoſes the veſſels to bleed a freſh, but generally makes him low and faint. If, ſoon after the operation, he complains of a ſickneſs at the ſtomach, or even a pain in that part of the abdomen near the bladder, it is not always a ſign of a dangerous inflammation, but frequently goes off in half an hour: to aſſiſt, however, in its removal, a fomentation put into an hog's bladder, and applied pretty warm to the part in pain, will be of great ſervice: if the pain increaſes, af-

ter two or three hours, the conſequence is much to be feared; and in this caſe, bleeding, and emollient clyſters by way of fomentation to the bowels, are immediately neceſſary.

The firſt good ſymptom after the operation is the urine coming freely away, as we then know the lips of the bladder and proſtate gland are not much inflamed. If the patient ſhould become languid, and continue without any appetite, bliſters prove beneficial; which may be applied with great ſafety, and little pain, as there is ſeldom or never any ſtrangury. About the third or fourth day a ſtool muſt be procured by a clyſter; for it ſeldom comes naturally the firſt time, and this method muſt be continued as every man's diſcretion ſhall guide him. As ſoon as the patient comes to an appetite, he ſhould be indulged in eating light food; with this caution, that he do not eat too much at a time.

If, during the cure, the buttocks ſhould be excoriated by the urine, let them be anointed with nutritum: the dressing from firſt to laſt is ſeldom any other than a ſoft digeſtive, or dry lint.

#### *Of the Stone in the URETHRA.*

If a ſmall ſtone be lodged in the urethra near the glans, it may often be puſhed out with the fingers, or picked away with ſome inſtrument; but if it ſtops in any other part of the channel, it may be cut upon without any inconvenience. The beſt way of doing it, is to pull the prepuce over the glans, as far as you can; and then making an incision the length of the ſtone, through the teguments, it may be turned out with a little hook or the point of a probe: The wound of the ſkin ſlipping back afterwards, to its proper ſituation, and from the oriſce of the urethra, prevents the iſſue of the urine through that oriſce, and very often heals in twenty-four hours. This is a much leſs painful method of extracting ſtones from the urethra, than by any inſtruments that have hitherto been deviſed.

#### *Of the extraction of the Stone in WOMEN.*

THE extraction of the ſtone in women, will eaſily be underſtood, ſince the whole operation conſiſts in placing them in the ſame manner as men, and, without making any wound, introducing into the bladder a ſtraight director, upon that a gorget, and afterwards the forceps to take hold of the ſtone: all which may be done without difficulty, by reaſon of the ſhortneſs of the urethra. If the ſtone proves very large, and in extracting draws the bladder forwards, it is adviſeable to make an incision through the neck of it, upon the ſtone; which not only will facilitate the extraction, but alſo be leſs dangerous than a laceration which will neceſſarily follow. The dressings are fomentations and emollient ointments, which ſhould be applied two or three times a day, and the patient in other reſpects be treated like men who have undergone the operation for the ſtone.

#### EXPLANATION of Fig. 4. Plate CLVII.

*A*, A ſound uſed in ſearching for the ſtone.

The ſize repreſented here is but a little too large for the youngſt children, and may be uſed upon boys till they are thirteen or fourteen years of age; a larger ſhould be employed between that age and adultneſs, when one of about ten inches, in a right-line from the handle to the extremity, is proper. This ſhould be made of ſteel, and its extremity be round and ſmooth.

*B*, A staff fit for the operation on boys from eight to fourteen years of age. The staff for a man must be of the size of the sound already described.

*C*, A staff something too big for the smallest children, but may be used upon boys from about four years of age to eight.

The staff has a groove on its convex side, which first serves as a direction where to cut, and afterwards receiving the beak of the gorget, guides it readily to the bladder. Care should be taken, in making the groove, that the edges of it be smoothed down, so that they cannot wound in passing through the urethra. The extremity should also be open; otherwise it will be sometimes difficult to withdraw the staff, when the gorget is introduced, and presses against the end of it.

These instruments are usually made with a greater bending than here represented; but this shape is more like to that of the urethra, and rather more advantageous for making the incision.

*D*, the yoke, an instrument to be worn by men with an incontinence of urine. It is made with iron, but for use must be covered with velvet. It moves upon a joint at one end, and is fastened at the other by catches at different distances placed on a spring. It must be accommodated to the size of the penis, and be taken off whenever the patient finds an inclination to make water. This instrument is exceedingly useful, because it always answers the purpose, and seldom galls the part after a few days wearing.

#### EXPLANATION of Fig. 5. Plate CLVII.

*A*, A small catheter made of silver. This instrument is hollow, and serves to draw off the urine when under a supposition. It is also used in the high operation to fill the bladder with water. Near its extremity, are two orifices, through which the water passes into its cavity. Care should be taken that the edges of these orifices are quite smooth.

*B*, The knife used in cutting for the stone: it is the same already described; but it is not improper to repeat the figure with the alteration of a quantity of tow twisted round it, which makes it easier to hold, when we perform the lateral operation, and turn the edge upwards to wound the prostate gland.

*C*, A female catheter, differing from the male catheter, it being almost straight; and something larger.

*D*, A silver-wire to pass into either catheter, for the removing any grumous blood or matter that clogs them up.

#### EXPLANATION of Fig. 6. Plate CLVII.

*A*, The gorget used upon men in the lateral operation.

*B*, The gorget used upon children under five years of age in the lateral operation.

A gorget between the sizes of these two will be fit for boys from five years of age to fifteen or sixteen.

These instruments are hollow for the passage of the forceps into the bladder; and their handles lie slanting, that they may the more readily be carried through the wound of the prostate, which is made obliquely on the left side of it. The beak at the extremity of the gorget must be smaller than the groove of the staff which is cut upon, because it is to be received in the groove. Care should be taken, that the edges of the gorget near the beak are not sharp, least, instead of dilating the wound, as it ought, it should only cut

on each side when introduced; in which case, it would be difficult to carry the forceps into the bladder.

*C*, A gorget, with its handle exactly in the middle; this shaped instrument is used in the old way. All the gorges should be made of steel.

#### EXPLANATION of Fig. 7. Plate CLVII.

*A*, The forceps for extracting the stone. These are represented a little open, that the teeth may be better seen within-side.

This instrument must be of different sizes for different ages and stones, from the length of four inches to one of near a foot long; but the forceps of about eight inches long will be found most generally useful. The number necessary to be furnished with, will be four or five.

Great care should be taken by the makers of this instrument, that it move easily upon the rivet; that the extremity of the chops do not meet when they are shut; and particularly that the teeth be not too large, lest, in entering deep into the stone, they should break it. It is of consequence also that the teeth do not reach farther towards the joint than here represented, because a small stone, when received into that part, being held fast there, would dilate the forceps excessively, and make the extraction difficult; on which account, the inside of the blades near the joint should be smooth, that the stone may slip towards the teeth.

*B*, A director made of steel, used for the direction of the gorget, in the extraction of the stone from women.

*C*, A scoop to take away the stone when it is broken into small pieces like sand. This instrument is made of steel.

#### Of the EMPYEMA.

THE operation for the empyema generally implies an artificial opening made into the cavity of the thorax, by which we evacuate any fluid that lies there extravasated, and is become dangerous by its weight and quantity. The fluids described as necessary to be voided by this operation, are blood, matter, and water.

When blood is the fluid, supposed to require evacuation by this method, it is always extravasated through some wound of the vessels of the lungs or thorax, and being discharged in great quantities on the diaphragm, is said to oppress respiration, till let out by some convenient opening made in the most depending part of that cavity, which is the only kind of perforation into the thorax distinguished by the name of the operation for the *empyema*: But though this opening is universally recommended in the case here stated, yet we meet with few or no examples where it has been practised for a mere extravasation of blood.

To empty the thorax, in a rupture of any vessels which open into it, bleeding is very necessary; which not only stops the hæmorrhage, by abating the force of the circulation; but likewise, by unloading the vessels of their contents, makes them more fit to receive the extravasated fluid by absorption: gentle evacuations and pectorals are also very serviceable, and a low diet is absolutely necessary.

The second circumstance in which this operation takes place, is a rupture of matter from the *pleura mediastinum* or lungs into the cavity of the thorax, where accumulating it at length proves fatal for want of a discharge. It is true, that the case occurs but very seldom, where the operation is necessary; because, in most abscesses of the thorax, the matter

matter is usually spit up as fast as it is generated; and in the dissection of such who have died of this species of consumption, we rarely find much extravasated pus in the cavity, though a great portion of the lungs be destroyed. However, there are a few examples which require the operation: and these may be distinguished by the following symptoms. The patient is obliged to lie upon the diseased side, or, in case there is matter in both cavities of the thorax, on his back; because the *mediastinum* can seldom support the weight of the incumbent fluid, without suffering great pain; but this rule is not certain, it sometimes happening that the patient can lie with ease on that side where there is no fluid. Another symptom of extravasated matter, is an evident undulation of it, so that in certain motions it may be heard to quash. For the most part too, upon careful inquiry, an *oedema*, or at least a thickening of some portion of the intercostal muscles, will be discovered. And lastly, if there be much fluid, it will be attended with a preternatural expansion of that side of the chest where it lies. When therefore these signs appear after a previous pleuritic or pulmonary disorder, and the case has been attended with the symptoms of a suppuration, it is most probably owing to a collection of matter; though the patient will also labour under a continual low fever, and a particular anxiety from the load of fluid.

The last sort of fluid said to require issue from this operation is water, which however very seldom collects in such manner as to become the proper subject of the operation: for if the dropsy of the thorax be complicated with an *anasarca*, or even *ascites*, it is certainly improper; and indeed it hardly ever takes place, but where the distemper is single, and takes its rise from the same sort of disorders in the lymphatics of the pleura, as the hydrocele does from those of the *tunica vaginalis*. The symptoms of this dropsy are, a small cough without spitting, a little slow fever from the disturbance of respiration; sometimes too the water, by a sudden jerk, may be heard to quash; and generally speaking, its weight upon the *diaphragm* and *mediastinum* are so troublesome as to oblige the patient to stoop forward, and to turn upon the affected side when he lies down; for the same reason, when there is water in both cavities of the thorax, he is forced to lie on his back.

The manner of operating, whether it be for the discharge of matter or water, is to pitch upon the most depending part of the thorax, which some have supposed to be between the eighth and ninth rib, and others between the ninth and tenth, at such a distance from the *vertebrae* that the depth of the flesh may not be an impediment to the perforation. This distance is determined to be about a hand's breadth: and here, with a knife, scissars, or trocar, we are ordered to make the perforation; but in doing it there are a great many difficulties. In fat persons, it is not easy to count the ribs, and the wound will be very deep, and troublesome to make; it is hardly possible to escape wounding the intercostal artery, which runs in this place between the ribs. But if the only advantage proposed by the situation of the wound be derived from its dependency, the purpose of discharging the fluid will be as well answered by an opening between the sixth and seventh rib, half way from the sternum towards the spine; which, by laying ourselves down, becomes in effect as depending an orifice, as the other in sitting up; and by an opening made in this manner we avoid all the inconveniences in the other method: For in this part of the thorax

there is very little depth of muscles; the artery lies concealed under the rib; and the diaphragm is at great distance. The opening is best made with a knife, and should be about an inch long through the skin, and half an inch through the subjacent muscles; though, to make the incision without the risk of wounding the lungs, it may be advisable to doate it with the blunt-pointed knife (as is practised in the operation for the *bubonocoele*) after having made a small puncture with a common knife. The treatment of the wound will be according to the nature of the discharge. If, after a few days, there appears no drain, you may let the orifice heal up; but if it continues, it may be kept open with a short silver canula, until such time as an alteration in that circumstance will give us leave to cicatrize with safety.

#### Of Encysted Tumours.

THESE tumours borrow their names from a cyst or bag, in which they are contained; and are farther distinguished by the nature of their contents: If the matter forming them resembles milk-curd, the tumour is called *atheroma*; if it be like honey, *meliceris*; and if composed of fat, or a suety substance, *steatoma*. The two first are not readily distinguished from one another, but their difference from the *steatoma* is easily learnt by their softness and fluctuation. These tumours appear in every part of the body, and in places where there are no glands.

The *steatoma* is never painful until by its weight it grows troublesome, nor is it a mark of general indispotion of body; so that the extirpation seldom fails of success. The size of some of them is very large, frequently weighing five or six pounds, and there have been instances of their weighing above forty.

When the *steatoma* is irregular in its surface, with eminencies and depressions, it is suety; whereas the fat one has for the most part a uniform smooth outside. The operation for the *steatoma* will be understood by the description of that for the schirrus.

The *atheroma* is much more common than the *meliceris*; at least, if all encysted tumours with matter not curdled, may, in compliance with custom, be called so: These are more frequent, and grow larger than those where the matter is curdled, being often attendant on scrophulous indispotions, which makes them more difficult of cure.

The cysts of these tumours, with the skin covering them, after a certain period of growth, resisting any further enlargement, do frequently inflame and break; but this opening is not so advantageous for the cure as extirpation by the knife, which should be done in the infancy of the swelling. When the tumours are no bigger than a small golden pippen, they may be dissected away from under the skin, by making a straight incision only through it; but if they exceed this bulk, an oval piece of skin must be cut through first, to make room for the management of the knife and taking away the tumour; in which case, it will be advisable to take off the upper portion of the cyst with the skin; and then, by the help of a hook, to dissect away as much of the remainder of it as can be conveniently, which is a less painful and more secure method than destroying it afterwards with escharotics. This rule is to be observed, when the cyst runs so deep amongst the interstices of the muscles, as to make it impossible to remove the whole of it, where, if we cut off a great quantity, the rest usually comes away in sloughs and matter.

The ganglion of the tendon is an encysted tumour of the

meliceris kind, but its fluid is generally like the white of an egg; when it is small, it sometimes disperses of itself; pressure and sudden blows do also remove it; but for the most part it continues, unless it be extirpated. It is no uncommon case to meet with this species of ganglion, running under the *ligamentum carpalæ*, and extending itself both up the wrist and down to the palm of the hand. The cure of this disorder cannot be effected but by an incision through its whole length and dividing the *ligamentum carpalæ*.

The dressing in these cases does not at all differ from the general methods of treating wounds.

*Of the Amputation of the Cancered and Scirrhus  
BREAST.*

THE success of this operation is exceedingly precarious, from the great disposition there is in the constitution, after an amputation, to form a new cancer in the wound, or some other part of the body. When a scirrhus has admitted of a long delay before the operation, the patient seems to have a better prospect of cure without danger of a relapse, than when it has increased very fast, and with acute pain.

The scirrhus may be distinguished, by its want of inflammation in the skin, its smoothness and slipperiness deep in the breast, and generally by its pricking pain, which as it is more or less, increases the danger accordingly; though there are some few with little or none in the beginning: as the tumour degenerates into a cancer, which is the worst degree of scirrhus, it becomes unequal and livid, and the vessels growing varicous, at last ulcerates.

In extirpating the scirrhus, if it be small, a longitudinal incision will dilate sufficiently for the operation; but if too large to be dissected out in that manner, an oval piece of skin must be cut through first, the size of which is to be proportioned to that of the tumour; for example, if the swelling is five inches long, and three broad, the oval piece of skin cut away must be nearly of the same length, and about an inch and a half in breadth. In taking off the whole breast, the skin may be very much preserved, by making the wound of it a great deal less than the basis of the breast, which must be carefully cleared away from the pectoral muscle. This is not difficult to do, because all these scirrhuses being enlarged glands are encompassed with their proper membranes, which make them quite distinct from the neighbouring parts, and easily separable; at least this is the case when the tumour is moveable; for sometimes it adheres to the subjacent muscle, and that muscle to the ribs; in which circumstance, the operation is impracticable. When it is attended with knots in the arm pit, no service can be done by amputation, unless the knots be taken away; for there is no sort of dependence to be laid on their subsiding, by the discharge of the wound of the breast.

The bleeding of the large arteries is to be stopped by passing the needle twice through the flesh, almost round every vessel, and tying upon it, which will necessarily include it in the ligature. In order to discover the orifices of the vessels, the wound must be cleaned with a sponge wrung out of warm water.

The scirrhusous tumours which appear about the lower jaw, are, generally speaking, scrophulous disorders, that distinguish themselves almost by the circumstance of fixing on the salivary glands. These are very stubborn of cure, but not so bad as the scirrhus, since they frequently suppurate, and heal afterwards; if they imposthume again after heal-

ing, it is for want of a good bottom, which may sometimes be procured by destroying their bad surface with a caustick. Besides these, there is another species of scirrhus in the neck, that succeeds better after extirpation than either of the former kind; this is an enlargement of the lymphatick glands, which run close up by the jugular vein, and is distinguishable from the cancers of this part, by its moveableness, want of pain, the laxness of the skin covering it, the small degree of pressure it makes on the *œsophagus* and *trachea*, and lastly the good habit of body, as it seldom affects the constitution, which cancers here do very early, after their first appearance. This tumour, from its situation, requires great exactness in the cutting off: they sometimes extend up to the chin towards the mouth, and occasion a division of the salivary duct in operating, which proves very troublesome to heal; but, when all other methods have failed, may be cured by a perforation into the mouth, through that part of the cheek where it is wounded, which by a tent or small seton may be made fistulous; then, by properly dressing upon the outside, the oozing of the *saliva* that way will be prevented, and the external orifice healed without difficulty.

The treatment of all these wounds may be with dry lint first, and afterwards as in common wounds.

*Of the Operation of the TREPAN.*

THE operation of the *trepan*, is the making one or more orifices through the skull, to admit an instrument for raising any pieces of bone that by violence are beaten inwards upon the brain, or to give issue to blood or matter lodged in any part within the *cranium*.

Fractures of the skull are at all times very dangerous, not in consequence of the injury done to the *cranium* itself, but as the brain becomes affected either from the pressure of the fractured bone, or that of the extravasated blood and matter. If then the symptoms excited by a fracture do sometimes follow from a mere extravasation of blood, as is the case when the *cranium* is not beaten inwards, it must likewise happen that a rupture of the vessels of this part, without a fracture, will also occasion the same disorders: For this reason, the operation may take place where the skull is not much offended, but only the vessels of the *dura mater*, the *pia mater*, or the brain.

When the *cranium* is beaten inward, without any fracture, it is called a depression; when very much broken, a fracture; or if broken and beat in also, a fracture with depression; if it is only cracked without depression, though properly a fracture, it is called a fissure; if none of these disorders appear, where there is a suspicion of them, the symptoms are imputed to a concussion of the brain. These are the four distinctions in use, and which fully comprehend all the others.

The depression of the *cranium* without a fracture can but seldom occur, and then it happens to children whose bones are more pliable and soft than those of adults.

In blows of the *cranium*, requiring the use of the *trepan*, the marks of a fracture are generally very evident, since the scalp is often lacerated so much, as to expose it to our sight: But if the wound of the scalp be so small, as only to admit a probe, we must judge then by the feel of the surface of the bone, using the caution of not mistaking a future for a fracture.

If there be no wound of the scalp, you must press about the

the head with your fingers, till the patient complains of some particular part, which in all likelihood is the place affected, and, if the scalp there be separated from the *cranium*, is almost infallibly so. The symptoms of a fracture, are, a bleeding at the ears and nose, a loss of sense, vomitings, drowiness, delirium, incontinence of urine and excrement; but what is most to be depended upon, is a depression of the bone, or a roughness on its outside; for all the other complaints not only happen to concussions, which do well without the application of a trepan, but likewise there are fractures not attended with any of them, or at least in a slight degree; so that these symptoms alone, without examination of the part affected, are but an uncertain rule to go by.

In concussions without a fracture, that produce the symptoms here laid down, and do well afterwards, the vessels of the brain and membranes are only inflamed and dilated; or if they are ruptured, they absorb the extravasated blood again; on which account, nature should be assisted by plentiful bleedings, clysters, and other evacuations, and so in all fractures where the patient is not trepanned immediately: however, although people with violent concussions do sometimes recover, it is so very seldom, that there can be no pretence, when they happen, for neglecting the trepan, but not being able to learn in what part the concussion is.

Writers dispute very much about the possibility of the *contra fissure*, or a fissure occasioned on the part of the head opposite to that on which the blow is given, or where the inner table is fractured while the outer one remains entire; but there are histories of cases, which, if fairly stated, make it unquestionable; and this is most certain, that if the complaint be at a distance from where the blow was received, that there can be no danger in scalping, and applying the trepan to that part where the pain is.

When we are assured of a fracture or depression, it is always advisable to trepan as soon as possible, in order to prevent the spreading of the abscess, which seldom fails to follow upon the rupture of the vessels of the brain and membranes, and for the most part in a few days.

The manner of treating a fracture of the *cranium*, will be according to the nature of the fracture itself, and the injury of the scalp. If the wound of the head be torn into angles, perhaps cutting off the lacerated flaps will make room for the saw; if the bone be broken into several pieces, the pieces may be taken away with the forceps; or if some of the skull be also depressed, the removal of the pieces, will, without perforating, make way for the elevator to raise the depressed part; but if the fracture be not complicated with a wound of the scalp, or the wound be too small to admit of the operation, which seldom fails to be the case, then the fracture must be laid bare, by taking away a large piece of the scalp.

Before the application of the trepan, it is to be remembered there are certain places on the skull where it cannot be used with so much safety as on others; the whole length of the sagittal suture, down to the nose, is always mentioned as one where the perforation is dangerous, because of the spine of the *os frontis*, and the course of the superior longitudinal *sinus* under this part, which it is supposed would be necessarily wounded by the saw and in consequence destroy the patient by the hemorrhage: but though a perforation may, contrary to the general opinion, be made over the *sinus* without offending it, and, even if it was wounded, the effusion of blood would not in all probability be mortal;

yet at best it would be very troublesome; and since we are not straitened in that part of the *cranium* for room, it is advisable to forbear operating in this place. The bony *sinus* of the *os frontis* forbid the use of the trepan near the orbits of the eyes; therefore, if it should be depressed near those cavities, the surgeon must be careful to perforate either above, or on one side of the fracture; for sawing below it will only lead into the *sinus*, and answer no purpose in the design either of giving a discharge to the matter from the brain, or an opportunity to elevate the depression; nay, perhaps leave an incurable fistula, if the patient escapes with life.

The *os occipitis* being very uneven, both in its internal and external surface, makes trepanning there almost impracticable; besides, the great sinuses run about so much of it, as hardly to afford space to perforate without danger of wounding them; but then it is so defended from injuries by its situation and strength, that fractures do not happen to it so often as to the other bones of the *cranium*; and when they do, for the most part they become so soon mortal, by affecting the *cerebellum* which it sustains, that the operation is seldom required in this case. Indeed the upper angle of this bone lies above the *cerebellum*, and, when fractured or depressed, is not attended with so immediate danger; but when this happens, the course of the longitudinal sinus down the middle of it, and the neighbourhood of the lateral *sinuses* beneath it, make it advisable to trepan at the lower part of the *os parietale*, or at least upon or just below the lambdoidal suture, so that the perforation of the *os occipitis* can hardly ever be proper.

Though wounds in the *cerebellum* are always mortal, yet great portions of the cerebrum have been carried off, or destroyed, without any notable inconvenience.

The places then unfit to admit the saw, are the three described; that is, the sagittal suture; that part of the *os frontis* near the orbits of the eyes; and the *os occipitis*. But when a fracture happens in any other part above the ear, there is no objection to the operation. When there is only a small fissure without any depression or motion in the bone, the trepan may be applied on the fissure itself, which will more readily give vent to the blood or matter underneath, than if made at a distance. If the fissure be large, and the bone weakened or depressed, the trepan must be applied on one side of it, but so as to make it a part of the circumference of the sawed piece; if the fracture run upwards, it will be eligible always to perforate near its bottom, because the dependency of the orifice will give better issue to the matter, though the ill-grounded apprehension of the brain falling out there has made many eminent surgeons contradict this rule in their practice. If, by making one orifice, you cannot raise all the depressed part, you must make a second and a third, and continue doing so, till you have reduced the whole *cranium* even: there is frequently occasion to repeat it twice or thrice; and it has been done twelve times, nay oftener, with success; which shews the little danger there is, either in sawing the skull, or exposing the *dura mater* and brain, when the pressure is taken off. Indeed the mischief of laying the brain bare is so small, compared with a concussion of it, or an abscess from pent-up matter, that those fractures of the skull, where the bone is broken into splinters the whole extent of it, and can be taken away, much more readily do well, than a simple fissure only, where the abscess cannot discharge itself freely; for which.

which reason, though the depressed fracture may be raised by the means of one orifice, yet, if it is of a considerable length, it will be almost absolutely necessary to make one or two more openings, for the convenience of discharge; since, for want of this, we see abscesses increase daily in their quantity of matter, and at the end of a few weeks carry off the patient.

In concussions of the brain without a fracture of the cranium, if the trepan be applied, and vast discharges ensue, it will be also convenient to make more perforations into the abscess and the neighbourhood of the abscess, the situation of which will be easily guessed by the direction of the stream of matter. And here it is to be observed, that abscesses which ensue from a concussion are generally more extensive and dangerous than those which accompany a fracture with depression: for in a fracture, the yielding of the bone destroys, in a great degree, the force of the striking body, and prevents any violent commotion of the brain; so that what the brain suffers results chiefly from the pressure of the incumbent bone, and the laceration of the vessels, near the fracture: whereas, when the cranium resists the shock, all, or great part of the *cerebrum* sustains the concussion, and is often impostumated or inflamed almost in its whole dimension.

The manner of trepanning is this: Having fixed your patient's head steady, either on the bolster of a bed, or by placing him in a low chair; with the pin of your saw, mark the center of the piece of bone to be taken out; then with the perforating trepan, make an orifice deep enough to receive the pin, which being fixed in it will prevent the saw from slipping; and thus you are to continue sawing, till the impression made will preserve the steadiness without the pin, when it is to be taken away, for fear of its wounding the brain before the saw has entered through the cranium, which it would do at last, because of its projection. In working through the bone, the teeth of the saw will begin to clog, by that time you arrive to the *diploe*; wherefore a brush must be ready to clean it every now and then, and with a pointed probe you must clear away the dust in the circle of the trepanned bone, observing if it be deeper on one side than the other, to lean afterwards on that side where the impression is least, that the whole thickness may be sawed through at the same time. To do all this with less interruption, it will be proper to have two saws of exactly the same diameter, that an assistant may be brushing one while you operate with the other. We are advised to saw boldly till we come to the *diploe*, which, it is said, will always distinguish itself by the bloodiness. But, however, this is not a certain mark to go by: for though, where there is a *diploe*, it will manifest itself by its bloodiness, yet sometimes the skull is so very thin as not to admit of any; in which case, if an operator should push on his instrument in expectation of meeting with this substance, he would unwarily wound the brain. This is not very often the case; but, however, often enough to put a man on his guard, and make him inquire whether the bone be loose after a little sawing, which is the only rule we go by when we have passed through the *diploe*, and may as well be attended to before coming at it, without any considerable loss of time. When it is quite sawed through, and lies loose, it may be taken away with the forceps contrived for that use; and if the lower edges of the orifice, next to the *dura mater*, are splintered, they may be scraped smooth with a lenticular,

These are the chief processes of the operation of the trepan. The only thing remaining to be done, is, with an elevator introduced at the orifice, to raise the depression, or broken splinters, if they cannot otherwise be laid hold of, and to draw out the grumous blood, or any other extraneous body. If the *dura mater* be not wounded or torn, an incision must be made through it, to give way to the blood or matter, which almost certainly lie underneath it, if the symptoms have been bad, and none has been discharged from between the *cranium* and *dura mater*: Though it has been lately observed that an abscess will sometimes be formed in the substance of the brain; and therefore, if the puncture of the *dura mater* does not procure an evacuation of the matter, and the symptoms of a suppuration are still urgent, it will be advisable to make a small incision with a lancet into the brain itself.

We have used the word trepan all along, for the sake of being better understood; but the instrument here recommended is a trephine; the advantages of which, as also that of a cylindrical saw, or one nearly cylindrical, are described in the explanation of the copper-plate.

With regard to the dressings of these wounds, it is very certain, that as the greatest part of the evil proceeds from the quantity and pressure of the matter, whatever approaches towards the nature of a tent, and increases its quantity and pressure by locking it up, must be pernicious. Therefore the use of all syndons whatever should be excluded. The hasty application too of spirits of wine, which is so commonly advised, cannot be proper; as they are not only unfit for inflammations in general, but also crisp up the vessels of the *dura mater* and brain, and, stopping the suppuration, sometimes produce a gangrene. Since then a clove application is inconvenient, and, whatever good there may be in topical medicines, it cannot for the most part be communicated to the abscess, by reason of its extent beyond the orifice, the best remedy will be dry lint only, which must be laid on loosely to give vent to the matter, and be repeated twice a day till the discharge is lessened, when once in twenty-four hours will be sufficient to the finishing of the cure, which will be something retarded by the exfoliations that sometimes follow this operation. The patient afterwards may wear a plate of tin upon the scar, to defend it from blows or any accidental injury.

#### EXPLANATION of Fig. 1. Plate CLVIII.

*A*, The perforator, commonly called the perforating trepan. With this instrument, an orifice is usually made for the reception of the pin, on the centre of the piece of bone that is to be taken away, in the operation of trepanning; though if the pin be very sharp, and project but little beyond the teeth of the saw, as in that marked with the letter *B*, the perforator would be needless; but as the point of the pin presently grows blunt with use, and in that case it is difficult to fix the saw, it is advisable to have this instrument in readiness. It is also handy for boring into the substance of the bones, in order to promote a granulation of flesh on their surfaces. When it is made use of, it must be received and fastened in the handle *C*.

*B*, The crown, or saw of the trepan, with the pin appearing just beyond the extremities of the teeth. The shape of this saw is cylindrical.

*C*, The handle of the foregoing instrument, called the trephine; which is much preferable to the trepan, (an instrument like a wimble used by joiners,) because of the great

great convenience of holding it, and leaning on one side or other of the saw, as we find it necessary: The trepan however, though allowed to be unhandy, is the instrument most used by surgeons in other parts of Europe, upon the supposition of its working quicker than the trephine.

The trephine here represented is of such a shape as to make it a convenient elevator, for which purpose the extremities of it are made rough.

D, A key to take out the pin E, when the saw has made an impression deep enough to be worked without the help of it.

#### EXPLANATION of Fig. 2. Plate CLVIII.

A, A convenient forceps to take out the circular piece of bone, when it does not stick to the saw: the contrivance by which they readily lay hold of it, is to make the extremities that are to grasp it, with an arch of the same circle as the saw is made. Upon one of the handles, there is added a little elevator, to lift up any small splinter of bone.

B, A lenticular: the fore-part of its blade is sharp, in order to scrape the lower edge of the orifice of the *cranium*, in case any splinters should remain after the operation; and the button at its extremity receives the dust, that it may not fall on the brain; but there is seldom any occasion for this instrument.

C, A rugine or raspatory, for scraping bones in order to promote granulations of flesh. The handles of these two last instruments are wood, whereas every part of the others should be made of steel.

#### Of the CATARACT.

THE cataract, called by the Latins *suffusio*, is a disease of the crystalline humour, rendering the whole body of it opaque, so that the rays of light, which, in the natural state of its transparency, were transmitted to the *tunica retina*, become now totally intercepted, and produce no effect. This is pretty nearly the account delivered down to us by Hippocrates and the ancient Greeks, who likewise knew it by the name of *glaucoma*.

Anatomists have frequently dissected the eyes of persons under this disorder after their death, and have found it to be always an opacity of the crystalline humour, agreeably to the definition of a *glaucoma*: so that by consequence we must understand the words *cataract* and *glaucoma* as synonymous terms.

The general criterion of the fitness of cataracts for the operation, is taken from their colour; the pearl coloured, and those of the colour of burnished iron, are esteemed proper to endure the needle; the white are supposed milky, the green and yellow horny and incurable.

The depression of a cataract of any colour would be the cure, if that alone was the distemper of the eye: but it generally happens, that the yellow cataracts adhere to the *iris* so firmly as to become immoveable; besides, when they follow in consequence of a blow, which is often the case, either the cells of the vitreous humour are so much disturbed and broken, or the *retina* affected, that a degree of blindness will remain, though the cataract be depressed.

To judge whether the cataract adheres to the *iris*, if you cannot at once distinguish it by your sight, shut the patient's eye, and rub the lids a little; then suddenly opening it, you will perceive the pupil contract, if the crystalline humour does not prevent the action by its adhesion: And

when this is the case in any kind of cataract, the operation can hardly be advised.

Another consideration of the greatest moment, before undertaking the cure, is to be assured of the right state of the *tunica retina*; which is very readily learnt, where there is no adhesion of the cataract, from the light falling between the *iris* and crystalline humour, which if the eye is not sensible of, it is a certain indication of another malady, and absolutely forbids the operation. Generally this cataract takes its rise from head-achs, convulsions, and nervous disorders.

When none of these objections forbid the operation, it may be thus done: Having placed your patient in a convenient light, and in a chair suitable to the height of that you yourself sit in, let a pillow or two be placed behind his back, in such a manner, that the body bending forward, the head may approach near to you; then inclining the head a little backward upon the breast of your assistant, and covering the other eye so as to prevent its rolling, let the assistant lift up the superior eye-lid, and yourself depress a little the inferior one: This done, strike the needle through the *tunica conjunctiva*, something less than one tenth of an inch from the *cornea*, even with the middle of the pupil, into the posterior chamber, and gently endeavour to depress the cataract with the flat surface of it. If, after it is dislodged, it rises again, though not with much elasticity, it must again and again be pushed down. If it is membranous; after the discharge of the fluid, the pellicle must be more broke and depressed: if it is uniformly fluid, or exceedingly elastick, we must not continue to endanger a terrible inflammation, by a vain attempt to succeed. If a cataract of the right eye is to be couched, and the surgeon cannot use his left hand so dexterously as his right, he may place himself behind the patient, and use his right hand.

We have not recommended the *speculum oculi*, because, upon the discharge of the aqueous humour through the puncture, the eye, being somewhat emptied, more readily admits of the depression of the crystalline humour, than when pressed upon by the instrument.

As to the method of treating the succeeding inflammation, bleeding and other gentle evacuations are found absolutely necessary.

#### Of Cutting the IRIS.

THERE are two cases where this operation may be of some service; one when the cataract is from its adhesion immoveable; and the other, when the pupil of the eye is totally closed up by a disorder of the muscular fibres of the *iris*, which gradually contracting the orifice, at last leaves the membrane quite imperforate. This last distemper has hitherto been deemed incurable. The adhesion of the cataract has been considered as a species of blindness not to be relieved: but Mr *Chéfelden* has invented a method of making an artificial pupil, by slitting the *iris*, which may relieve in both the instances here stated.

In doing this operation, the patient must be placed as for couching, and the eye kept open and fixed by the *speculum oculi*, which is absolutely necessary here; then introducing the knife in the same part of the *conjunctiva* you wound in couching, insinuate it with its blade held horizontally, and the back of it towards you, between the *ligamentum ciliare* and circumference of the *iris*, into the anterior chamber of the eye: and after it is advanced to the farther side of it,

make your incision quite through the membrane; and if the operation succeeds, it will upon wounding fly open, and appear a large orifice, though not so wide as it becomes afterwards.

The place to be opened in the *iris*, will be according to the nature of the disease: if the membrane itself be only affected with a contraction, the middle part of it, which is the natural situation of the pupil, must be cut; but if there be a cataract, the incision must be made above or below the cataract, though it is more eligible to do it above.

The contracted *iris*, from a paralytic disorder, is so often complicated with an affection of the *retina*, that the success is very precarious in this case. This operation has answered best in adhesions of the crystalline humour, though but very seldom even there.

#### EXPLANATION of Fig. 3. Plate CLVIII.

A, The couching needle, the broad part of which towards the point is flat on one side; but on the other is a little convex to give it more substance and strength.

The handle of this instrument is white-ivory, inlaid with a streak of black in that part of it lying even with the convex surface of the blade: The meaning of which is, that by holding the handle with the streak upwards, we may be guided to depress the membrane of a milky cataract with the flat surface, though the substance of the cataract swimming in the eye obscures the needle, and prevents its being directed in a proper position by the sight.

B, A *speculum oculi*, which is made to open or shut by an iron button sliding along a slit in the handle. This instrument is composed of one piece of steel, in such a manner that it would fly open by its elasticity, if the two branches of the handle were not confined by the button. The circle of it should be covered with velvet, to make it lie softer on the eye-lids.

C, The knife for cutting the *iris*, the blade of which has two edges, resembling a lancet, which are more advantageous than one only, in cutting the *cornea* for the extraction of the cataract.

#### Of the FISTULA LACHRYMALIS.

THE *fistula lachrymalis* is generally understood to be such a disorder of the canals leading from the eye to the nose, as obstructs the natural progress of the tears, and makes them trickle down the cheek: but this is only the first and mildest stage of the disease. In the next, there is a mucus resembling matter, and afterwards matter itself discharged with the tears from the *puncta lachrymalia*, and sometimes from an orifice broken through the skin between the nose and angle of the eye. The last and worst degree of it is, when the matter of the abscess, by its long continuance, has not only corroded the neighbouring soft parts, but also affected the subjacent bone.

Monsieur Ansell, a French surgeon, recommends in the recent fistula, to pass a small probe through one of the *puncta lachrymalia* into the *sacculus* and nose, in order to break the concretions which were supposed to make the obstruction, and with a small-pipe and syringe to throw an injection through the other, in order to wash them away.

The manner of operating in those cases where perforation is not required, is this: Supposing the abscess not broken, chuse a time when it is most turgid with matter; and to his end, you may shut the patient's eye the day before,

and lay little slips of plaister upon one another across the lids, from about the *puncta lachrymalia* to the internal angle; which compressing their channels, and preventing the flux of the matter that way, will heap it up in the bag, and indicate more certainly the place to be cut. If the abscess is already open, the orifice and probe will inform you where to enlarge: then placing the patient in a seat of convenient height for the management of your hand; with a small incision-knife dilate from the upper part of the bag, down to the edge of the orbit, without any regard to the tendon of the orbicularis muscle, or fear of wounding the blood-vessels; though if you see the vessels, it is proper to shun them. The length of this incision, will be near four tenths of an inch. It has been advised, in opening the bag, to introduce a small probe through one of the *puncta* into its cavity, to prevent wounding the posterior part of it. But this excess of care may be more troublesome than useful; since, in so large a vessel, a very small share of dexterity is sufficient to avoid the mistake. In making this incision, care must be had, not to cut too near the joining of the eye-lids, because of the deformity of the succeeding scar; though the bleed eye or uneven, contraction of the skin in that part, after the operation is generally owing to the use of the cautery, and not to the wound of the tendon of the orbicularis muscle; for this last is necessarily from its situation always cut through, but without any inconvenience, because of the firm cicatrix afterwards that fixes it strongly to the bone.

When the bag is open, it is to be filled with dry lint, which the next day may be removed, and exchanged for a dossil dipt in a soft digestive medicine: this must be repeated every day once or twice, according to the quantity of the discharge; now and then, when the matter is not good, using the precipitate medicine, and from time to time a sponge-tent, to prevent the too sudden reunion of the upper part of the abscess. When the discharge begins to lessen, it will be proper to pass a small probe, a small bougie, or silver wire, through the nasal duct into the nose every time it is dress'd, in order to dilate it a little, and make way for the tears and matter which by their drain will continue to keep it open. This method must be followed till the discharge is nearly over (which will be in a few weeks;) and then dressing superficially with dry lint, or any drying application, the wound will seldom fail of healing. After the cure, in order to prevent a relapse, it will be proper, for a few weeks, to wear the compressing instrument represented in the copperplate.

When the bone is bare, and the fistula requires perforation, the perforator is not to be carried down the *ductus ad nasum*, for fear of boring into the *sinus maxillaris*; but more internally towards the nose, which will bleed freely, if properly wounded. The wound afterwards should be dress'd with dossils, in the manner above described, and the probe or silver wire be every day pass'd through the *ductus ad nasum*. lest, after the cure of the abscess, it should still remain obstructed; and if, upon trial, the duct should be so fill'd up as not to admit the wire, it will be right to keep open the perforation into the nose with a small tent, till the discharge is almost quite ceased.

#### EXPLANATION of Fig. 4. Plate CLVIII.

A, The eye, with the skin of the eye-lids denud'd, in order to shew the orbicularis muscle: the white streak running from the inner angle of the eye toward the nose is the *tendon*

tendon of the orbicularis muscle. At a little distance from the internal angle, on the edge of the eye-lids may be observed two black spots, which are the orifices of the lachrymal channels, and called the *puncta lacrymalia*.

*B*, The exact dimension of the lachrymal channels and bag; the pricked line represents the edge of the orbit.

*C*, A small incision-knife, more handy than a larger for opening the bag.

*D*, The perforator to destroy the *os unguis*, if ever it should happen to be necessary.

*E*, An iron instrument made thin and pliable, to set even on the forehead, and for use covered with velvet: the holes at the three extremities receive two pieces of ribband, by which it is fastened on the forehead: the button at the end of the screw is to be placed on the *sacculus lacrymalis*, and the screw to be twisted till the button makes a considerable pressure on the bag: the button should be covered with velvet, and a little compress of plaister be laid on the bag before it is applied, to prevent the skin from being galled by the pressure. The little branch of iron which receives the screw must be soft enough to admit of bending, otherwise it will be difficult to place the button exactly on the bag. This instrument is for the left eye only; it should be worn night and day in the beginning of a fistula, and after a fistula has been healed by incision; but as the success depends upon the exact situation of the button upon the bag, it should be carefully looked after.

#### Of BRONCHOTOMY.

THE operation of *bronchotomy* is an incision made in the *aspera arteria*, to make way for the air into the lungs, when respiration is obstructed by any tumour compressing the *larynx*, or some other disorder of the *glottis* and *aspera arteria*, without any apparent tumour.

The manner of doing it, is by making a longitudinal incision through the skin, three quarters of an inch long, opposite to the third and fourth ring of the trachea, if you have the choice of the place; and when you cannot make it so high, the rule will be to wound a little below the tumour: it is always advised to pinch up the skin for this process, which however may be left to the discretion of the surgeon. When the skin is cut through, you must make a small transverse incision into the wind-pipe, and immediately introduce a silver crooked *canula* near half an inch long, with a couple of little rings at the top of it, through which a ribband may be passed round the neck, to keep it fixed in the wound.

The method of dressing will be easily understood; since, after the patient can breathe by the natural passage, if you withdraw the hollow tent, the wound will become a simple one, and, notwithstanding its penetration through a cartilage into a large cavity, require a superficial application only.

#### Of the Extirpation of the TONSILS.

THESE glands sometimes grow so large and scirrhus as to become incurable, and even to threaten suffocation if not extirpated. The manner of doing this operation formerly, was by cutting them off: but the almost constant consequence of this wound was a violent bleeding, and sometimes too a mortal one; on which account it is rejected in favour of the ligature, which is not only void of danger, but also seldom fails of cure.

If the basis of the tonsil is smaller than the upper part, you may pass the ligature by tying it to the end of a probe, bent into the form of an arch, and set into a handle; which being carried beyond the gland, and round it, is to be brought back again: this done, you may easily tie it by the means of an instrument of Mr. *Chefelden's* contrivance, which holds one end of the string on the side of the tonsil next the throat, while you make the knot by pulling the other with the right hand quite out of the mouth, as will be easily understood by the draught in the copper-plate. Should it happen that the tonsils are conical, so that the ligature will necessarily slip over its extremity when we attempt to tie; in this case, he has recommended an instrument like a crooked needle, set in a handle, with an eye near the point, threaded with a ligature, which is to be thrust through the bottom of the gland, and being laid hold of with a hook, the instrument is to be withdrawn; then pulling the double ligature forwards, it must be divided, and one part be tied above, and the other below the tumour: the knots are to be always double, and the ligature to be cut off pretty near them.

If after four or five days they slip, or seem to have mortified the tonsil only in part, you must repeat the whole operation; and if it fail a second time, you must even repeat it again.

This kind of extirpation is more practised in large piles, that are esteemed incurable. When the piles are withinside of the intestine, you must place your patient over a fomentation in a clofestoole, and have a crooked needle with a double ligature ready to pass through them, when by straining they are pushed out of the *anus* (for sometimes the intestine will return suddenly,) and tie above and below as in the instance of the tonsil. Sometimes the piles are of that shape as to admit a single ligature to be tied round them without the help of a needle, which is less painful. If there are several, you must only tie one or two at a time; for the pain of the ligature is excessive, and would be intolerable if many were tied at once: however, every five or six days, the operation may be repeated till all are extirpated, and the parts must be kept supple by some emollient ointments.

When the piles are small, they may safely and with much less pain be cut off.

The *uvula* is subject to so great a degree of relaxation sometimes, that it almost chokes the patient; the readiest cure is cutting off all but half an inch of it, which may be done at one snip with a pair of scissors (particularly curved for that purpose,) laying hold of it with a forceps, lest it should slip away.

#### EXPLANATION of Fig. 5. Plate CLVIII.

*A*, The bent probe fixed in a handle, with the ligature made of the same thread as the ligatures for tying the blood-vessels.

*B*, The iron instrument for tying the tonsils.

This instrument is also of great service in extirpating, by ligature, a species of scirrhus that sometimes grows from the neck or cavity of the *uterus*.

*C*, The needle with the eye towards the point, for passing the ligature through the tonsil, when the basis is larger than the extremity.

*D*, A *canula* made of silver to be used in the *empyema*.

*E*, A *canula* to be used in *bronchotomy*.

To keep the *canulas* in their place, small ribbands may be

be passed through the rings of them, and carried round the body and neck; or they may be held by a ligature run through, and fastened to a hole cut in a piece of sticking plaster, which is to be laid on each side of them.

#### Of the POLYPUS.

THE polypus of the nose, is said to be an excrescence of flesh, spreading its branches amongst the *laminae* of the *os ethmoides*, and through the whole cavity of one or both nostrils. It happens very often to both sides of the nose at once; and in that case is very troublesome, almost suffocating the patient, at least making respiration very difficult. The intent of the operation is the removal of this obstacle.

*Polypi* arise from the membrane spread upon the *laminae spongiosae*, pretty nearly in the same manner as the *hydatids* of the *abdomen*, in one kind of dropsy, do from the surface of the liver; or as ganglions from the tendons, borrowing their coats from a production of its fibres and vessels: If they appear soft, and of the colour of the serum of the blood, in all likelihood they are formed of such a sort of water contained in cysts, which, upon breaking the membrane, leaves so little hold for the instrument, that but a small part of it can be extracted afterwards. This *polypus* is to be left to harden, before the operation be undertaken, which in process of time it generally will do. In the next degree of consistence, they retain pretty nearly the same colour, and are often partly watery, and partly of a viscid texture, which though not tenacious enough to admit of drawing them out by the roots, may at several attempts be taken away by bits. The next degree of consistence, is that which is neither so soft as to be squeezed to pieces, nor so hard and brittle as to crumble, or adhere to the membrane with that force as not to admit of separation: this is the most favourable one. The last, is hard and scirrhous, adhering so tight as to tear rather than separate in the extraction, and sometimes even tends to degenerate into a cancer: This *polypus* is very difficult of cure.

The *polypus* sometimes dilates to that degree, as not only to extend beyond the *os palati*, and hang over the *oesophagus* and *trachea*; but also spreading into the *sinus maxillaris*, so exactly fills up every interstice of the nose, as to obstruct the lower orifice of the *ductus ad nasum*, and prevent the descent of the tears, which necessarily must return thro' the *puncta lachrymalia*; and sometimes they grow so enormously large, as even to alter the shape of the bones of the face.

When the *polypus* appears in the throat, it is always advisable to contract it that way; it being found, by experience, more ready to loosen when pulled in that direction, than by the nose. To this end, it would be right, before undertaking the operation, to let your patient lie supine two or three hours, which will bring it still farther down; for the body of the *polypus* does not universally adhere, and will by its weight stretch out the fibres by which it is connected to the nose; nay, there are instances, where by a little effort, such as hawking, they have dropt quite off.

The method of extracting it is by a pair of forceps, with a slit at their extremities for the better hold, which must be introduced into the nostril about an inch and a half, to make more sure of it towards the roots; then twisting them a little from one side to the other, you must continue in that action, while you pull very gradually the

body of the *polypus*. If it break, you must repeat the extraction as long as any remains, unless it is attended with a violent hæmorrhage, which is an accident that sometimes follows upon the operation, and seldom fails when the excrescence is scirrhous: However, the surgeon is not to be alarmed at the appearance of an immoderate effusion the moment after the separation; for, generally speaking, the vessels collapse very soon again; but if they do not, dry lint, or lint dipt in some styptic, will readily stop it.

After the extirpation, it has been usual, in order to prevent a relapse, to dress with escharotick powders, and even to burn with the actual cautery; but neither the one or the other can be of great service in this case, and both are painful and dangerous. If ever the use of corrosive medicines is adviseable, it should be for destroying the remainder of a *polypus* which cannot all be taken away; and then the escharoticks may be better conveyed to the part by a long tent, than a seton passed through the nose and mouth, which is difficult to do without hurting the patient, and very nasty to bear.

#### Of the HARE LIP.

THIS disease is a fissure in the upper lip, with want of substance, and is a natural defect, the patient being always born with it, at least that species of hare-lip which requires the following operation. The cure is to be performed by the twisted suture. There are many lips, where the loss of substance is so great, that the edges of the fissure cannot be brought together, or at best where they can but just touch, in which case it need not be advised to forbear the attempt: it is likewise forbidden in infants, and with reason if they suck; but otherwise it may be undertaken with great safety, and even with more probability of success than in others that are older.

It is not uncommon for the roof of the mouth to be fissured likewise; but this is no objection to the operation, if the skin of the lip is loose enough to admit of reunion: and it may be remarked, that the fissure of the palate, in length of years, closes surprisingly in some cases.

The manner of doing it is this. You first with a knife separate the lip from the upper jaw, by dividing the *freemulum* between it and the gums; and if the *dentes incisivi* project, as is usual in infants, they must be cut out with the same knife; then with a thin pair of straight scissors take off the callous edges of the fissure the whole length of it, observing the rule of making the new wound in straight lines, because the sides of it can never be made to correspond without this caution. For instance, if the hare lip had the shape *a*, Plate CLVIII. fig. 5 the incision of the edges must be continued in straight lines till they meet in the manner represented by *b*, *ibid*. The two lips of the wound being brought exactly together, pass a couple of pins, one pretty near the top, and the other as near the bottom, through the middle of both edges of it, and secure them in that situation by twisting a piece of waxed thread cross and round the pins seven or eight times; you must then cut off the points, and lay a small bolster of plaster underneath them, to prevent their scratching: but when the lower part only of the hare lip can be brought into contact, it will not be proper to use more than one pin.

The pins are made three fourths of their lengths of silver, and the other part towards the point of steel; the silver pin is not quite so offensive to a wound as a brass or steel one;

but a steel point is necessary for their easier penetration, which indeed makes them pass so readily, that there is no need of any instrument to assist in pushing them through. The practice of bolstering the cheeks forward does little or no service to the wound, and is very uneasy to the patient. The manner of dressing will be to remove the applications which are quite superficial, as often only as is necessary for cleanliness. The method is to desist the three first days, and afterwards to do it every day, or every other day: It is not at all requisite to dress between the jaw and lip where the *frænum* was wounded, there being no danger that an inconvenient adhesion should ensue. In about eight or nine days the parts are usually united, and in children much sooner, when you must gently cut the threads, and draw out the pins, applying upon the orifices a piece of plaster and dry lint. It will be proper, in order to withdraw the pins more easily, to daub the ligatures and pins with warm water, and also moisten them with sweet oil, two or three days before you remove them, which will wash off the coagulated blood, that would otherwise fasten them so hard to the ligature as to make the extraction painful.

#### Of the WRY NECK.

THE operation of cutting the wry neck is very uncommon, and is never to be practised but when the disorder is owing to a contraction of the *massoideus* muscle only; as it can answer no purpose to set that muscle free by dividing it, (which is all that is to be done,) if the others in the neck are in the same state; and more especially if it has been of long standing from infancy; because the growth of the *vertebræ* will have been determined in that direction, and make it impossible to set the head upright.

When the case is fair, the operation is this. Having laid your patient on a table, make a transverse incision thro' the skin and fat, something broader than the muscle, and not above half an inch from the *clavicle*; then passing the probe razor with care underneath the muscle, draw it out and cut the muscle. The great vessels of the neck lie underneath; but when we are aware of their situation, the danger of wounding them may be avoided. After the incision is made, the wound is to be crammed with dry lint, and always dressed so as to prevent the extremities of the muscle from re-uniting; to which end they are to be separated from each other as much as possible by the assistance of a supporting bandage for the head, during the whole time of the cure, which will generally be about a month.

#### EXPLANATION of Fig. 6. Plate CLVIII.

A, The instrument called the probe razor to cut the *massoideus* muscle in the wry neck, and is sharp only about half its length at that end where the blade is broad.

B, The two pins with the twisted suture, used in the hare-lip.

C, The *polypus* forceps, with one of the rings open for the reception of the thumb, which would be cramped in pulling the forceps with much force, if it were received in the same sort of ring as in the other handle.

#### Of the ANEURISM.

THIS is a disease of the arteries, in which, either by a preternatural weakness of any part of them, they become excessively dilated; or by a wound through their coats, the blood is extravasated amongst the adjacent cavities. The

first species of *aneurism* is incident to every part of the body, but does not often happen, except to the curvature of the *aorta*, which is subject to this disorder from the extraordinary impulse of the blood on that part: from the curvature, it runs upwards along the carotids or subclavians, generally increasing, till by its great distension it is ruptured, and the patient dies.

There are several histories given of *aneurisms* of the curvature of the *aorta*; in some of which, the vessel has been so excessively dilated, as to possess a great space of the upper part of the *thorax*; and the most curious circumstance to be gathered from them is, that the spot of the vessel which is weakest, and where the disease begins, generally gives way in such a manner to the force of the blood continually pushing it outwards, as to form a large pouch or cyst, with coats nearly as thick as those of the artery itself. However, the thickness of the coats of these cysts will last but to a certain period; for when the vessels of the coats can no longer conform to the extension, the circulation grows languid, the cyst becomes thinner at its apex, and soon after bursts.

The symptoms of this *aneurism*, are a strong pulsation against the *sternum* and ribs; every *ystole* of the heart; and, when it extends above the *sternum*, a tumour with pulsation. Upon dissection, the ribs, *sternum*, and *clavicle*, are sometimes found carious, from the obstruction of the vessels of the *periosteum*, which are pressed by the tumour.

What we have spoken of hitherto, has been only the *aneurism* of the *thorax* from an internal disorder; *aneurisms* of the extremities, are for the most part owing to wounds, though when they happen of themselves, they differ very little from the description given of that in the *thorax*. The further symptoms of them are (besides pulsation) the tumour's being without discoloration of the skin; its subsiding when pressed by the hand, and immediately returning when the hand is taken away; though, if it be upon the point of bursting, the skin will grow inflamed, and the coagulated blood in the cyst will sometimes make the pulsation much less perceptible.

This species of *aneurism* may sometimes be supported a great number of years, if we resist its dilatation by proper bandage; but if we do not, there is danger of its bursting, and, if it be pretty large, of rotting the adjacent bones.

A sound artery wounded through part of its external coat would in all probability produce nearly the same appearances as where the whole coat is weakened from an internal indisposition; and this most likely is the case after bleeding in the arm, when it has not been immediately perceived that the artery was pricked, and the tumour has begun to form some days after the puncture; though the common appearance of an *aneurism* from the wound of a lancet, is a discharge of blood first through the orifice of the skin, and, upon being stopt from bleeding outwardly, an insinuation of it among all the muscles as far as it can spread, in the shoulder and arm: here, the arm grows livid from the *ecchymosis*, and the blood coagulating to the consistence of flesh, prevents any sensible pulsation. The cyst which arises near the orifice of the artery is formed by the cellular capsula enveloping the vessels of that part, and a portion of the *aponeurosis* of the biceps muscle, which admitting of some extravasated blood underneath it, become excessively thickened and expanded. These membranes must make the cyst, otherwise we could not, upon opening the tumour in the operation,

peration, discover so readily the puncture; or if the coats of the artery made it, we could not separate it distinctly from the vessel, which would be always dilated above and below the cyst, as we see in other *aneurisms*.

There are some few instances of small *aneurisms* and punctures of the artery from bleeding, doing well by bandage; but they almost all require the operation at last, which is to be performed nearly in the same manner in every part; and supposing it in the bend of the arm, is to be done after the following method.

Having applied the tourniquet near the shoulder, and laid the arm in a convenient situation, make an incision on the inside of the *biceps* muscle, above and below the elbow a considerable length, which, being in the course of the artery, will discover it as soon as you have taken away the coagulated blood, which must be all removed with the fingers, the wound being dilated sufficiently for that purpose. If the orifice does not readily appear, let the tourniquet be loosened, and the effusion of blood will direct you to it; then carefully carrying a crooked needle with a ligature under it, tie the vessel just above the orifice; and passing the needle again, make a second ligature below it, to prevent the return of the blood, and leave the intermediate piece of the vessel to slough away without dividing it. To avoid wounding or tying the nerve in making the ligature, the artery may be cleared away from it first, and held up with a hook; but should the nerve be tied with the artery, no great inconvenience would ensue from it. After the operation, the arm must be laid easy, on a pillow in bed, and the wound be treated in the common method, keeping it in that posture a fortnight or three weeks, especially if it should swell much, and not digest kindly.

In doing this operation, it will be proper to have the amputating instruments ready, lest it should be impracticable to tie the artery; and even after having tied it, the arm must be carefully watched; and in case of a mortification, it may be taken off.

#### Of AMPUTATION.

A spreading mortification has been always esteemed so principal a cause for amputation, that it is a fashion with writers to treat of the nature of a gangrene previous to the description of this operation. However, this operation is spoken of as frequently unsuccessful; and in length of time, its want of success has been so unquestionably confirmed by repeated experiments, that some of the most eminent practitioners make that very circumstance an exception to the operation, which so few years since was the great inducement; and the maxim is, never to extirpate till the mortification is absolutely stopped, and even advanced in its separation.

Gangrenes may be produced two ways; either by indispotion of body, or by accident in a healthful state: for as the life of a part depends upon the circulation of its fluids, whatever shall make the circulation cease, will inevitably occasion a gangrene. Thus a mere compress preventing the course of the blood, as effectually causes a mortification as any indispotion in the fluids or vessels.

It frequently happens in old age, that the arteries of the lower extremities ossify, which destroying their elasticity, must in consequence produce a gangrene in the toes first, and afterwards in the limb nearly as high as where the ossi-

fication terminates; so that in mortifications arising from this cause, we at once see why amputation, during their increase, is of so little service, unless performed above the ossification; but we have no way to judge where the ossification ends, but by the inference we make from the gangrene's stopping: Hence we may learn the propriety of our modern practice in this case.

If by any accident the limb has been injured to that violent degree as to begin to mortify, it will be no more fit to operate here till it stops, than in the other instance; because all parts that are mortified have had the disposition to become so, before the effect is produced: and cutting off a limb, half an inch above the absolute dead skin, is generally leaving a part behind, with the seeds of a mortification in it; so, unless we can be sure the vessels are not affected in the place of amputation, which will be hard to know but from the consequence, the operation will be useless.

Sometimes the fluids of the body are so vitiated, as to lose their proper nutritious qualities: and the limb becomes gangrened, not from any alteration in its vessels, but chiefly from its situation, which being at a great distance from the heart, will be more prone to feel the ill effects of a bad blood than any other part, as the circulation is more languid in the extremities; and it seems not very improbable, that in some dispositions of the blood, a mortification may also be a kind of critical discharge. When therefore a gangrene arising from either of these causes, is running on, amputation above it will for the most part be useless, since it is only removing one degree of the effects of the bad juices, and leaving them in the same state to produce the like mischief in other parts. Thus we see, after amputations on this account, the gangrene sometimes fall on the bowels, or the other extremities: from which observation we may conclude it not safe to amputate, till the fluids are altered; and this alteration will presently discover itself by the stopping of the mortification.

Gunshot wounds, compound fractures, and all sudden accidents requiring amputation, are attended with the best success if immediately performed. Disorders of the joints, ulcers of long standing, and all scrophulous tumours, do sometimes return on other parts after the operation. When a leg is to be amputated, the manner of doing it is this.

Lay your patient on a table two feet six inches high, which is much better than a low seat, both for securing him steady, and giving yourself the advantage of operating without stooping, which is not only painful, but inconvenient in the other situation. While one of the assistants holds the leg, you must roll a slip of fine rag half an inch broad, three or four times round it, about four or five inches below the inferior extremity of the *patella*: This being pinned on, is to serve as a guide for the knife, which without it perhaps would not be directed so dexterously: The manner of rolling has always been perpendicular to the length of the leg; but having sometimes observed, that though the amputation at first be even, yet afterwards the *gastrocnemius* muscle contracting, draws back the inferior part of the stump more strongly than the other muscles can do the rest of it; in order to preserve the regularity of the cicatrix, allow for this excess of contraction, and make the circular incision in such a manner that the part of the wound

wound which is on the calf of the leg is a little farther from the ham than that on the shin is from the middle of the *patella*.

In the mean time, one of your assistants must carry a strong ligature round the thigh, about three or four inches above the *patella*, which passing through a couple of slits in a square piece of leather, he must twist with a tourniquet, till the artery is sufficiently compressed, to prevent any great effusion of blood; and to do it more effectually, he may lay a bolster of tow or linen under the ligature, upon that part where the artery creeps. It will also be a little more easy to the patient, to carry a compress of linen three or four times double, round the thigh, on that part where the ligature is applied, in order to prevent it from cutting the skin.

The course of the blood being stopped, you must begin your incision just below the linen roller, on the under part of the limb, bringing your knife towards you, which at one sweep may cut more than the semicircle; then beginning your second wound on the upper part, it must be continued from the one extremity to the other of the first wound, making them but one line. These incisions must be made quite through the *membrana adiposa*, as far as the muscles; then taking off the linen roller, and an assistant drawing back the skin as far as it will go, you make your wound from the edges of it when drawn back, through the flesh to the bone, in the same manner as you did through the skin. Before you saw the bones, you must cut the ligament between them, with the point of your knife; and the assistant who holds the leg while it is sawing, must observe not to lift it upwards, which would clog the instrument; and at the same time, not to let it drop, lest the weight of the limb should fracture the bone, before it is quite sawed thro'.

In amputating below the knee, it is of advantage to stand on the inside of the leg; because the *tibia* and *fibula* lie in a position to be sawed at the same time, if the instrument be applied externally: whereas, if we lay it on the inside of the leg, the *tibia* will be divided first, and the *fibula* afterwards; which not only lengthens the operation, but is also apt to splinter the *fibula* when it is almost sawed thro', unless the assistant be very careful in supporting it.

When the leg is taken off, the next regard is to be had to the stopping the blood; which must be effectually done before the patient is put to bed, or there will be great danger of bleeding again, when the fever is excited, and the vessels of the stump dilated, both which happen a very little while after the operation. There is no method for this purpose so secure, as taking up the extremities of the vessels with a needle and ligature in the following manner. As soon as the amputation is performed, the assistant must loosen the tourniquet for a moment, upon which the orifices of the arteries will appear by the issue of the blood. The operator having then fixed his eye upon one of the largest vessels, passes a crooked needle through the flesh, a little more than a quarter of an inch above the orifice, and about the same depth, in such a direction as to make nearly one third of a circle round the vessel: then withdrawing the needle, he a second time passes it into the flesh and out again, in the same manner and about the same distance below the orifice of the vessel. By this means, the thread will almost encompass the vessel, and when it is tied (which should be done by the surgeon's knot) will necessarily inclose it within the stricture. All the considerable arteries are to be

taken up in the same manner; that is, the tourniquet is to be loosened in order to discover the vessel, and then the needle is to be passed round. This is a much better way than using the artery forceps, where the vessels are apt to slip away out of the ligature: and as to styptick applications, their want of safety is so well known, that the use of them, in hæmorrhages from large vessels, is almost universally rejected; though it is thought by several surgeons who have experienced the virtue of agaric, that it will be found to be a more powerful astringent than any hitherto discovered.

It sometimes happens in a large stump, that ten or more vessels require tying; which done, you must apply loose dry lint to the wound; or in case the small vessels bleed plentifully, you may throw a handful of flour amongst the lint, which will contribute to the more effectual stopping up their orifices. Before you lay on the pledget, you must bind the stump, and begin to roll from the lower part of the thigh down to the extremity of the stump. The use of this roller is to keep the skin forwards, which, notwithstanding the steps already taken to prevent its falling back, would in some measure do so, unless sustained in this manner. The dressing may be secured by the cross cloth and gentle bandage; and the method of treating the wound may be learnt from what has been said with respect to recent incised wounds.

In amputating the thigh, the first incision is to be made a little more than two inches above the middle of the *patella*. After the operation, a roller should be carried round the body, and down the thigh, to support the skin and flesh: this is also the most proper bandage, as abscesses will sometimes form in the upper part of the thigh, which cannot discharge themselves so conveniently with any other, it being almost impracticable to roll above the abscess, unless we begin from the body.

The amputation of the arm or cubit differs so little from the foregoing operations, that it will be but a repetition to describe it. However, it must be laid down as a rule, to preserve as much of the limb as possible, and, in all amputations of the upper limbs, to place your patient in a chair.

The amputation of the fingers and toes is better performed in their articulation, than by any of the other methods: for this purpose, a straight knife must be used, and the incision of the skin be made not exactly upon the joint, but a little towards the extremity of the fingers, that more of it may be preserved for the easier healing afterwards: it will also facilitate the separation in the joint, when you cut the finger from the *metacarpal* bone, to make two small longitudinal incisions on each side of it first. In these amputations, there is generally a vessel or two that require tying, and which often prove troublesome when the ligature is omitted.

It may happen that the bones of the toes, and part only of the *metatarsal* bones, are carious; in which case, the leg need not be cut off, but only so much of the foot as is disordered: a small spring-saw is better to divide with here, than a large one. When this operation is performed, the heel and remainder of the foot will be of great service, and the wound heal up safely.

#### EXPLANATION of Fig. 7 Plate CLVIII.

A. The figure of the amputating knife. The length of the blade and handle should be about thirteen inches.

B. The figure of the saw used in amputating the limbs. The length of the handle and saw should be about seventeen inches.

### OF LUXATIONS.

A BONE is said to be luxated or dislocated, when it is moved out of its place or articulation, so as to impede its proper motion and office.

#### LUXATION of the NOSE.

It sometimes happens, that the bones of the nose are separated from each other, or distorted out of their natural places, by some violent blow or fall. When such an accident happens, it is several ways discovered: as, (1.) By the sight, when we behold the deformed position of the nose; or, (2.) By feeling; or lastly, (3.) By the ear, when perceive with what difficulty the patient draws his breath through his nostrils.

When this case happens, the patient is to be speedily placed in a high chair, that an assistant may stand behind and hold his head firm, in a proper posture: the surgeon is then to introduce with one hand, a thick probe, a goose-quill, or little stick shaped for the purpose, up the nostril internally, by which means the depressed parts of the nose may be thrust into their places: in the mean time he applies his other hand externally, to guide and direct the parts which are moved from within: this being done, there is scarce any thing else required but to let a bit of sticking plaster lie upon the nose at the same time.

#### Of a DISLOCATION of the LOWER JAW.

THE lower jaw is indeed seldom luxated, because it is held so firm by strong ligaments and muscles, by whose assistance it is retained in two sinuses in the basis of the *cranium*: but when it is by accident forced out from thence, it may chance to be on one side only, or else on both, it being then thrust directly forwards: and this happens most frequently from opening the mouth too wide in yawning; though it has sometimes been occasioned by a violent blow or fall. If it be luxated on both sides, the chin will incline downward, and the jaw will be thrust very forward: but if only on one side, the chin will be inclined toward the opposite side; the elapsed little head of the jaw not being capable of dislocation but forward and inward; for the processes of the bones of the *cranium* prevent the jaw from being dislocated backwards.

The lower jaw is chiefly known to be luxated on one side, when the chin is distorted on the opposite side: for that part to which the chin inclines, is the sound; but that from whence it recedes, is the luxated one: the mouth in this case gapes wider than usual, so that the patient cannot shut it, nor eat with his teeth; the lower range of teeth being projected beyond, and on one side the upper: but when the jaw is luxated on both sides, then the mouth not only gapes wide and open, but the chin also hangs down, and is thrown directly forwards; so that the patient cannot shut his mouth, speak distinctly, or even swallow any thing without much difficulty.

When the jaw is out only on one side, and the case recent, the cure is usually not so very difficult; but when both heads are dislocated, and not presently restored to their places, it always occasions the worst of symptoms, as pains,

inflammations, convulsions, fevers, vomitings, and at length death itself.

When this kind of luxation happens, the patient is to be directly seated on a low stool, so that an assistant may hold his head firm back against his breast. Then the surgeon is to thrust his two thumbs as far back into the patient's mouth as he well can; but they are first wrapped round in a handkerchief, to prevent them from slipping or being hurt; and his other fingers are to be applied to the jaw externally: when he has got firm hold of the jaw, it is to be strongly pressed, first downwards, then backwards, and lastly upwards, but so as that they may be all done in one instant; by which means the elapsed heads of the jaw may be very easily shoved into their former cavities.

If the jaw be out on one side only, every thing must be done in the same manner: but the luxated side of the jaw must be forced more strongly downward and backward than the sound one.

#### Of LUXATIONS of the HEAD and SPINE.

THE luxations which happen in the *spine* and *vertebræ* of the back are generally imperfect ones. For it appears from an accurate consideration of the structure and articulation of these bones, that none of the *vertebræ* can be entirely displaced without being fractured, and also compressing or wounding the spinal marrow, which must produce danger of instant death. Even the imperfect luxations of these bones are very dangerous: which happen either between the two superior *vertebræ* of the neck and the head, or else between the rest of the *vertebræ*, when they are forced from each other.

Such as have a luxation between the head and upper *vertebra*, seldom escape being carried off by a speedy and sudden death: for in this case the tender *medulla* which joins immediately with the brain, and is lodged in the spine, the brain itself, and the nerves which arise beneath the *occiput*, are too much distended, compressed, or lacerated; the two condyloide processes of the *occiput* usually slip out of their glenoide sinuses in the first *vertebra* of the neck, when a person falls headlong from a high place, from off a ladder, from on horseback, or when he receives a violent blow upon his neck: they dying very suddenly in this case, are vulgarly said to have *broke their neck*, though there is generally no more than a luxation: yet it sometimes happens that the *vertebræ* of the neck are really fractured. If life should remain after such a luxation, which very rarely happens, the patient's head is commonly distorted with his chin close down to his breast, so that he can neither swallow any thing, nor speak, nor even move any part that is below his neck: therefore, if speedy assistance be not had, death ensues, from the compressure or hurt of the *medulla*.

But to repulse this unwelcome messenger, the patient is to be immediately laid flat upon the ground or floor: then the surgeon kneeling down with his knees against the patient's shoulders, is to bring them together so as to contain the patient's neck between them: this done, he quickly lays hold of the patient's head with both his hands, and strongly pulling or extending it, he gently moves it from one side to the other; till he finds, by a noise, the natural posture of the neck, and the remission of the symptoms, that the dislocation is properly reduced: by this method the surgeon retains the patient firm between his knees, and

performs the extension and reduction between his hands.

It will be proper, in order to prevent a tumor, and restore the stretched ligaments of the neck to their former vigour, to bathe it with *aq. Hungar. sp. vin. campb.* or some other strengthening spirit applied warm, as also compresses dipped in the same: the patient should bleed, and rest gently for some days, till the neck be found sufficiently strong and well.

With respect to the rest of the *vertebræ* of the back, they are seldom moved quite out of their places, unless they are fractured, they being retained, for the greatest part, by adhering to the adjacent ligaments and muscles: therefore the luxations which happen among them are usually imperfect; no more being displaced than their two upper or lower processes, and they often but on one side; and this happens sometimes to one of the spinal *vertebræ*, and sometimes to more. But it is here to be briefly observed, that it is usual to include among the number of luxated *vertebræ*, that which is found and firm, but intercepted by others which are not so: thus whenever the upper *vertebræ* of the loins from the last of the back, and lowermost *vertebræ* of the loins next the *os sacrum*, are luxated, we commonly say and reckon there are five *vertebræ* out of their places; when, strictly speaking, only the two outermost or the uppermost and lowermost of those *vertebræ* are disturbed, the three middle ones retaining their natural situation and connection.

The signs common to luxations in the *spina dorfi* are chiefly the following: the back itself is found to be crooked or unequal, after the external violence has been inflicted; the patient can neither stand nor walk, and his whole body seems to be paralytic; the parts which are beneath the luxated *vertebræ* are nearly without all sense and motion; the excrements and urine cannot be discharged, or else they are sometimes emitted involuntarily; the lower extremities grow dead by degrees; and, at length, death itself follows: but these symptoms vary in proportion to the degree of violence in the luxation.

Luxations of the spinal *vertebræ* are very difficult to reduce. The following seems to be the most suitable method of reducing luxations of the *vertebræ*: when the *apophyses* of the *vertebræ* are dislocated on both sides, the patient is to be laid leaning upon his belly over a cask, drum, or some other gibbous body; then two assistants are strongly to press down both the ends of the luxated spine, on each side; by which means the bones of the spine will be set free from each other, lifted or pushed up in the form of an arch, and so gradually extended. This done, the surgeon presses down the luxated *vertebræ*, and at the same time nimbly pushes the superior part of the body upwards: and by this means the luxated *vertebræ* are sometimes commodiously reduced into their right places; but, if success should not attend the first time, the method should be repeated two or three times more.

It seems proper, after the *vertebræ* are reduced, to bathe the spine with *sp. vin.* or to lay on compresses dipped in *sp. vin. campb.* Afterwards the patient is to be laid in a soft and even bed; bleeding, and bathing the weak parts with strengthening spirits, are to be used as there may be occasion.

#### Of Luxations of the Os Coccyx, and Ribs.

THE *os coccyx* may be thrust inwards by a violent fall or blow, and it is often pushed outwards in hard birth. When

this happens, it is usually attended with violent pain and inflammation about the lower part of the spine, abscesses form in the *intestinum rectum*, and the *faces* are contused or suppressed. To discover the luxation of this bone the more readily, we have recourse to the use of our hands and eyes, as well as to the knowledge of the forementioned symptoms: nor is the replacing this bone very difficult, if attempted by a careful and expert surgeon; for if it be thrust outwards, it must be depressed into its right place by the thumb, after which may be applied compresses dipped in warm wine, or its spirit, made broad above, and narrow below, to fill up the posterior *sinus* of the *nates*; and these may be held on by the T bandage; but that part of this bandage which comes between the thighs should be slit, and placed so that the patient may go to stool without undoing the bandage, and to prevent the bone from being by that means displaced again.

When the *os coccyx* happens to be luxated inwards, the first finger is to be introduced into the *anus*. After it has had its nail cut and been dipped in oil, it must be thrust as far as possible, that it may the more readily drive out the depressed bone; the other fingers being applied externally, are to conduct the bone into its right posture: when this has been done, it will be proper for the patient to rest some time upon the bed; and when he sits up, it should be in a chair with a hole in its bottom, lest the affected part should be otherwise compressed or disturbed.

The ribs are indeed sometimes, though but seldom, dislocated; for upon the assault of some external violence, it is not uncommon for them to be displaced either upwards, downwards, inwards, or outwards. They cannot be easily luxated outwards, because prevented by the vertebral processes, and resisted by very thick and strong muscles: but when they are drove into the cavity of the *thorax*, they not only lacerate the *pleura*, but do generally great injury to the contained parts; in consequence whereof arise most sharp pains, inflammations, difficulty of breathing, cough, ulcers, immobility, and many other dangerous symptoms of the like nature.

When the rib is dislocated either upwards or downwards, in order to replace it conveniently, the patient is to be laid on his belly upon a table, and the surgeon must strive to reduce the luxated rib into its right place with his hands; or, the arm of the disordered side may be suspended over a gate or ladder, and while the ribs are thus stretched up from each other, the heads of such as are luxated may be pushed into their former seat.

But those luxations wherein the heads of the ribs are forced into the *thorax*, are generally found to be much the most difficult to reduce; since neither the hand, nor any other instrument, can be applied internally to direct the luxated heads of the ribs: in this case it seems proper to lay the patient on his belly over some gibbous or cylindrical body, and to move the fore-part of the rib inwards towards the back, shaking it sometimes; for thus generally the head of the luxated rib slips into its former place: but if this method of cure will avail nothing, and the deplorable condition of the patient requires speedy help, we have no remedy left but incision, and endeavouring to replace the luxated head of the rib with the fingers, pliers, or little hooks. In the mean time, where the symptoms are not very urgent, and the heads of the ribs but little displaced, it is advisable neither to cut the flesh, nor violently force the ribs; be-  
cause

cause there are several instances where the luxated ribs have retained their dislocated stations without any hurt: but above all, care must be taken to lay on a compress dipped in warm *Sp. Vin.* or *Sp. Vin. Campb.*

The clavicles may be dislocated either from the top of the *sternum*, or *processus acromion* of the *scapula*, by some external violence, as a fall, blow, the lifting some great weight, or the like.

#### Of a LUXATION of the HUMERUS.

THE *humerus*, from the length and laxity of its ligaments, the largeness of its motion, and the shallowness of the cavity in the *scapula*, into which it is articulated, is thereby rendered of all bones the most subject to be luxated. The head of this bone may often be dislocated under the arm-pit, sometimes forwards, sometimes backwards, and even below the *spacula*; but seldom perpendicularly downwards, and never directly upwards unless the *acromion* and *coracoide* processes of the *scapula* should chance to be fractured at the same time: besides, as long as the strong *deltoide* and *bicipital* muscles of the *humerus* remain entire, they greatly resist and keep down the *humerus* from being luxated upwards.

When the *humerus* is luxated downwards, (1.) There suddenly appears a cavity, and upon pressing with the fingers you will perceive a *sinus*; but under the arm there must be a tumour, because the head of the bone is thrust there. (2.) The *processus acromion* will seem to stick out further than usual, because of the adjacent *sinus*. (3.) The luxated arm will be longer than the other, and it cannot be lifted up towards the head without violent pain, and sometimes it cannot be lifted up at all, or even extended. But when the *humerus* is luxated forwards as well as downwards, there will be observed the same *sinus* under the *processus acromion* as before, and a tumour will appear from the head of the *humerus* projecting towards the breast, under the *axilla*: the arm itself also cannot be moved without exciting the most acute pain. Lastly, When the *humerus* is luxated backwards, the *cubitus* is thrown forwards towards the *præcordia*, and the head of the bone makes a protuberance in the shoulder; the arm itself cannot be bent nor extended, nor even pulled outwards from the breast, without occasioning the most violent pains: but no luxation of this limb is attended with such dangerous symptoms, as when it is dislocated forwards or inwards; because the luxated head of the *humerus* cannot avoid injuring the large arteries and nerves of the arm; in consequence of which, various symptoms will arise.

As soon therefore as the luxation is discovered in the *humerus*, the safest way will be to seat the patient on the floor, or on a low stool. Two strong assistants are to be placed on each side the patient: one of which should secure his body, and, if possible, the *scapula* too, that it may not give way to the extension; while the other lays firm hold of the luxated arm with both his hands, a little above the *cubitus*, gradually and strongly extending it. But before that extension be made, the surgeon himself should have a large napkin, of a sufficient length, tied at the ends, and hung about his neck so that the knot may be behind; but the other part of the napkin must hang over his breast: then the patient's arm must be put through the napkin up to the shoulder, and the surgeon at the same time lays hold of the head of the *humerus* with both his hands: this done, he

orders the assistant to extend the limb sufficiently, and in the mean time he himself elevates the head of the patient's *humerus* by the napkin about his neck, directing it with his hands, till it slip into its former cavity in the *scapula*.

#### Of a LUXATION of the CUBITUS.

THE *cubitus*, consisting of two bones, the *ulna* and the *radius*, is articulated by *ginglymus*. The connection of these bones is such, that the *ulna* or *cubitus*, as being the largest bone, and seated in the inferior part of the arm, does of itself perform the whole flexion and extension of the arm; yet it cannot perform that motion without carrying the *radius* along with it; so that the *radius* always follows the *ulna* in flexion and extension; but, on the other hand, the *radius* may be turned along with the hand both inward and outward, without at all moving or bending the *ulna*; as when the pronation and supination of the hand is made thereby. Both these bones of the *cubitus* are so articulated with the lower head of the *os humeri*, that large protuberances are received into deep cavities or grooves, and the whole invested and fastened with exceeding strong ligaments; so that notwithstanding, the *cubitus* may be luxated in all four directions, outward, inward, forward, and backward, yet it is but seldom that it suffers a perfect or entire dislocation, unless the upper part of the *ulna*, called *olecranon*, be broken, or the ligaments of the *cubitus* much weakened, by some very great external violence.

If the *cubitus* be luxated backward, which is the most frequent of all others, then the arm becomes crooked and shorter, and it cannot be extended. In the inward part of the bend of the arm, the head of the *humerus* may be observed to stick out; in the back part of the same, the head of the *ulna* or *olecranon* will be protuberant, and between both bones will appear a *sinus* or cavity. But it very seldom happens that the *cubitus* is luxated forward, from the largeness of the *olecranon*: unless that be fractured at the same time. But if this should happen, the head of the *humerus* will stick out behind, and that of the *cubitus* before; and there will be a cavity more or less in proportion to the degree of the luxation. When the *cubitus* is luxated externally, the protuberance appears on the outside of the *cubitus*; and the contrary when luxated inwards. To conclude, unless the ligaments and muscles of the *cubitus* are quite broken in two, it is so far from being capable of suffering a perfect dislocation, that no more can happen to it than a subluxation, *i. e.* it can but recede but a very little way out of its right place: but whatever of this kind happens, the case may be very easily understood, by feeling and inspecting the part, if there be no tumor; but if the joint be much swelled, it is very difficult to be discovered.

Be the luxation, however, more or less, the patient must be speedily placed in a chair; and both parts of the limb, the *humerus* and the *cubitus*, must be extended in opposite directions by two stout assistants, till the muscles are found pretty tight, with a free space between the bones: then the luxated bone must be replaced with the surgeon's bare hands, or together with bandages; and that the processes may fall into their *sinuses*, the *cubitus* must be afterwards suddenly bent. But if the tendons and ligaments are so violently strained, that they can scarce perform their office; it will not be improper to anoint them well with emollient oils, ointments, or the fat of animals, or to apply emollient fomentations and cataplasms.

As soon as the reduction has been by these means effected, the articulation must be bound up with a proper bandage, and the arm is to be afterwards suspended in a napkin or sling about the neck: but care must be taken, that the bandage be not suffered to be on too long, nor the arm to be kept all the time still, without some gentle motion.

*On LUXATIONS of the HAND, CARPUS, METACARPUS, and FINGERS.*

NOTWITHSTANDING the hand is very accurately connected to the two preceding bones, and particularly to the *radius*, by means of the *carpus* and strong ligaments, yet it sometimes suffers luxation in all four directions; but it is generally not so easy to be luxated on either side, as forward or backward, because of the two processes of the *radius* and *ulna*, which guard it on each side. The hand is said to be luxated *forwards* or *inwards*, when it recedes from the muscles which bend the fingers; to be luxated *backward*, when it departs from the muscles which extend the fingers: much also in the same manner, the hand is judged to be luxated *outward*, when the *carpus* makes a tumor near the thumb, and a cavity near the little finger; to be luxated *inward*, when the contrary happens.

It seems to be the safest way immediately to reduce what is displaced; and that this may succeed the better, two things are to be chiefly regarded: (1.) That the luxated hand be sufficiently extended by two assistants, one of which is to lay hold of the hand, and the other of the *humerus*, pulling in opposite directions: (2.) That the part of the extended hand, where the *sinus* is, be placed on a table, or some other flat body, that whatever sticks up may be depressed: by which method the hand, in whatever part luxated, may be very readily reduced into its natural seat.

It also sometimes happens, that one or two of the eight little bones of the *carpus* are luxated and distorted from their natural seat by some external violence. When this happens, there will be perceived a tumor in one part, and a cavity in another, which may be also felt by the fingers; besides, violent pains will be felt by the patient. For the rest, as this kind of luxation is very easily discovered, partly by the sight, and partly also by feeling; so, when it is recent, it is almost as readily cured, letting the hand be extended in the manner we before proposed, and the dislocated bone be afterwards forced into its place.

The four small bones, which are found in the *metacarpus* or palm of the hand, may be sometimes luxated from the *carpus* itself, to which their upper parts are connected; which usually happens from some external violence. The two bones which are seated in the middle between the two other external ones, cannot be dislocated to either side; as the two external ones which sustain the first and little fingers cannot be luxated inwardly, but are more easily driven outward: though each of them may be luxated on the fore or back part of the hand. But which ever of these happens, the particular disorder may be discovered and examined by feeling and inspecting, and the cure may be carried on in altogether the same method which we directed before.

Lastly, The bones of the fingers, to which we join those of the thumbs, are liable to luxation at each of their articulations, and that in several directions. But these accidents, if recent, are both very easy to discover and cure: for the ligaments being not very robust, the fat and muscles thin, and the *synoves* of the articulations shallow, ren-

der the extension very easy, and the reduction of them into their former places may be done very readily. While one hand of the surgeon extends the finger, he strives with his other to replace the bones in their natural seat.

*Of a LUXATION of the THIGH.*

VERY rare is it that the head of the thigh-bone is displaced out of its *acetabulum*; though formerly it was supposed to be pretty frequent, physicians taking a fracture thereof for a luxation, the reason whereof may be taken from the articulation itself: (1.) How very deep is the *sinus*, called by the ancients *sinus coxæ*; and by the moderns *acetabulum*, into which the head of the thigh-bone is received. (2.) With what a broad concave cartilage is almost the whole head of that bone covered. (3.) How strong are the ligaments with which it is fastened. (4.) How greatly it is defended with exceeding stout and thick muscles. (5.) But how very brittle is the neck of this bone beyond any other part thereof: from all which it appears, that the neck must be far more frequently and easily broke, especially in adults, than its head dislocated: and though something of this kind may sometimes happen, so as to make the head of the thigh-bone slip out of its *acetabulum*; yet that generally proceeds more from internal than external causes: for we find it has been observed by very skilful physicians, that the ligaments of the thigh-bone, though very strong, may be by various causes, and particularly by a flux of humours, so relaxed and weakened, as to let the head of that bone slip spontaneously out of its *acetabulum*; so that it should seem no great wonder if the thigh should be sometimes luxated even while the patient lies in bed, without any external violence, so that when they rise, one leg appears longer or shorter than the other, and seems as if it were unhinged.

But this case does not happen so easy in robust adults, as in such as are more young and tender.

Whenever the said head of the thigh-bone is thrust out, it is almost always wholly displaced, so as to make a perfect luxation. The exact roundness of this head, with the great force of the circumjacent muscles, and the narrowness of the sides of the *acetabulum*, will not admit the bone to be dislocated a little way only; for as soon as the head of this bone is thrust up to the edge of the *acetabulum*, it must unavoidably either turn quite out, or else fall back again into its right place.

The thigh is usually luxated four ways; *upward*, *downward*, *backward*, and *forward*; but it is most frequently dislocated downwards and inwards, towards the large *foramen* in the *os pubis*: for besides that the cartilaginous defence on the lower part of the *acetabulum* is not so high as the rest, the *ligamentum rotundum* is found to give way more easily in that part than any other: and lastly, the adjacent muscles are found to be weakest in their resistance on this part, being insufficient to keep the head of this bone from slipping out; and then there is a certain eminence in this edge of the *acetabulum*, which keeps the head of the *os femoris* from falling back again into its right place: but if the head of this bone be displaced outwards, it generally slips upwards at the same time; it being scarce possible but the very strong muscles of the thigh must then draw the bone upwards, and then there is no eminence there, in the edge of the *acetabulum*, to resist the head of the bone in that passage; but should it at any time be luxated by an external

ternal force, there must certainly be a rupture of the round ligament.

When the thigh is dislocated forwards and downwards, which is what usually happens, the leg hangs straddling outward, and is longer than the other; also the knee and foot turn outwards; the head of the bone itself will be felt near the lower part of the *inguen* and *os pubis*; sometimes there is a suppression of urine in this case; when some nerve, which communicates with the bladder, is violently compressed; in the buttock may be perceived a cavity, from the *trochanter major* and the rest of the bone being displaced; and if the thigh-bone be not timely replaced into its *acetabulum*, the whole limb withers shortly afterwards; and this is the reason why the patient can bear little or no stress upon that limb, but must always incline and throw the weight of his body upon the other.

But if the thigh-bone be displaced backward, it is usually drawn upward also at the same time: hence there will be perceived a cavity behind the *inguen*; but upon the haunch or buttock, a tumour; because the head and *trochanter* of this bone will be thrust there. The tumour in the haunch being thrust upwards, the rest of the limb will become shorter than the other, and the foot will seem to turn inwards; the heel will not touch the ground, and so the person will seem to stand upon his toes; and lastly, the luxated limb may be bent with more ease than extended.

We do not without reason judge the thigh to be luxated, (1.) When we find the ligaments of the bone have been relaxed by some preceding congestion of humours, and when no external violence has been exerted upon it, especially in young patients. (2.) When neither the symptoms, pain, tumour, or inflammation follow: and lastly, (3.) When the whole limb may be bent and turned about at the *acetabulum* without any crushing of the bones, which is otherwise common in fractures. The contrary of these signs are strong indications that a fracture is present; more particularly if the foot in grown persons be shorter, from the injury of any external violence, and you hear a grating of the bones in moving the limb.

The luxated bone is always to be replaced in a method agreeable to the nature and direction of the dislocation. When it is displaced forwards and downwards, the patient is to be laid flat upon his back on a table; then a linen napkin or strong sling is to be made fast over the groin about the part affected, so that one end of the sling may come over the belly, and the other over the *nates* and back, to be both tied together in a knot upon the spine of the *os ilium*, and afterwards fastened to a hook fixed in some post, or held firm by some assistants; rather the first, if we use the polyspaston or pulley, to retain the patient's body firm from giving way in the extension; in like manner, at the bottom of the thigh, a little above the knee, there must be also fastened another napkin, or sling, with a compress between it and the thigh. Both the slings being drawn tight, the thigh is to be extended, not vehemently, but only so much as is sufficient to draw the bone out of its sinus, that it may be replaced into its *acetabulum* by the surgeon's hands; one hand is to press the head of the thigh-bone outward, while the other conducts the knee inwards; or, the reduction may be made by napkins, fastened round the extremities of the thigh like slings, much as in a luxation of the humerus: which will be more likely to succeed if the knee be at the same time pressed in-

wards by the hands. When the fore-mentioned means are not sufficient to make the extension, it will be necessary to make use of the polyspaston or pulley. As soon as the thigh is found to be sufficiently extended, the surgeon must take particular care to restore the luxated head of the thigh-bone with his hands from the *os pubis* into its former seat.

Whenever the thigh is luxated backward, the patient is to be placed flat on a table, with his face downward; and the thigh is to be extended in directly the same manner, but a little more strongly than we just now proposed; and the reduction is to be effected afterwards by the surgeon's hands, an assistant in the mean time extending the limb, and turning it inwards; by this means the head of the thigh-bone generally slips very readily again into its *acetabulum*.

#### Of a LUXATION of the PATELLA and KNEE, or TIBIA and FIBULA.

THE *patella* is usually luxated mostly on the internal or external side of the joint; but whenever the knee is perfectly luxated, the *patella* can scarce avoid being displaced at the same time, because of its strong connection to the thigh and *tibia*.

The reduction of a luxated *patella* is usually no very great difficulty, if the patient be laid flat on his back upon a table or bed, or if he be laid in that posture upon an even floor, so as that the leg may be pulled out straight by an assistant: for then the surgeon may firmly grasp the *patella* with his fingers, and afterwards press it strongly into its right place; which may be also effected if the patient stands upright: when this is done, there remains nothing but carefully to bind up the disordered part, and to let the patient rest quietly for some days, sometimes gently bending and extending his leg to prevent it from growing stiff, till the pains are gone off, and the limb has recovered its former strength.

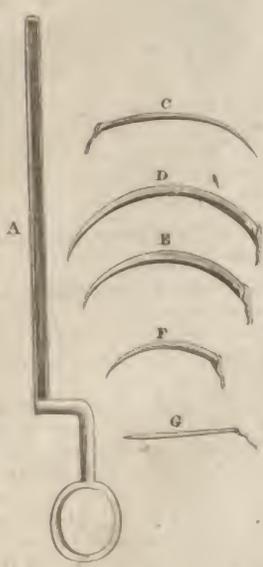
A luxation of the knee is properly so, when the *tibia* recedes from under the *femur*. The leg is sometimes luxated from the basis of the thigh-bone, either on the out or inside, or backwards; seldom or never forwards, unless it be forced and driven very violently that way; because forwards, the *patella* is bound against the articulation, by the very strong tendons of the muscles which extend the leg; nor is it easy for the bones of the leg to be wholly displaced from that of the thigh, so as to make a perfect luxation; by reason of the great strength of the ligaments, and the two deep *sinuses* which receive the head of the thigh-bone.

As this kind of luxation is very easy to discover from the thin covering of the joint, with the tumors and cavities which follow; so, when it is discovered, it is as difficult to make a perfect cure thereof, without letting the bones join together; or leaving some stiffness in the knee; which first accident is usually called an *anchylosis*.

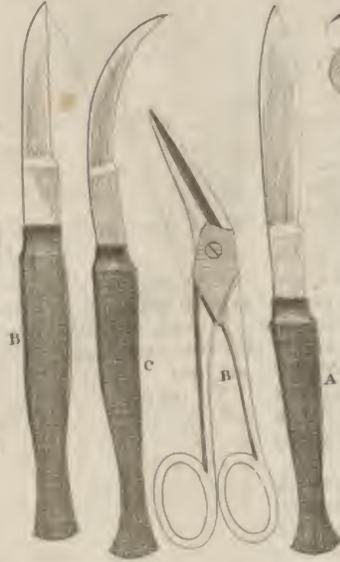
When the knee is but slightly luxated, the patient is to be seated on a bed, bench, or table, and one assistant holds the thigh firm above the knee, and the other extends the leg; but the surgeon in the mean time replaces the bones by his hands and slings if necessary, or pushes it by the application of his knee into its natural place.

Sometimes the *fibula* is separated by some external violence from the thigh-bone, and is then distorted either upward or downward: and this generally happens, when the foot has been luxated outward; therefore, when this is the case, there is need of extension. The bone is to be first restored

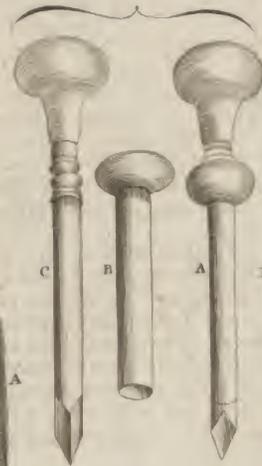
Fig. 1.



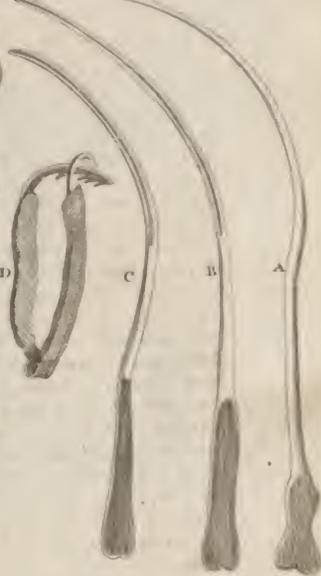
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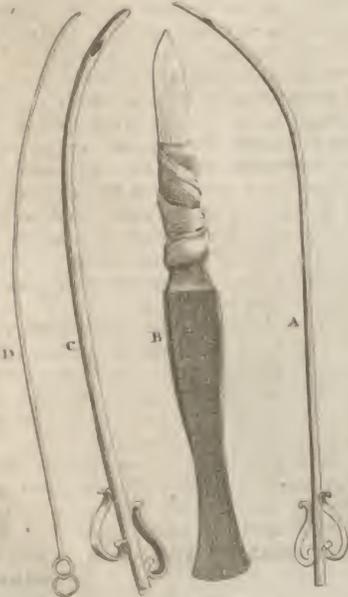
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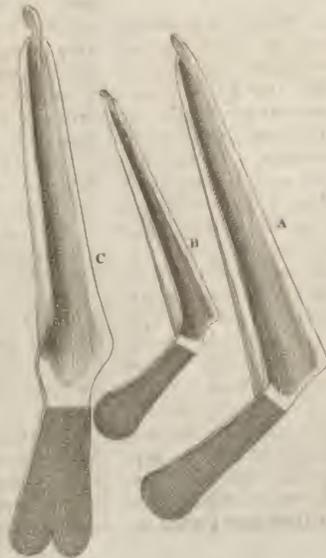
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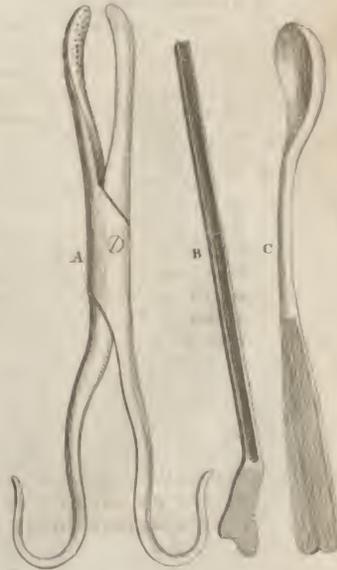
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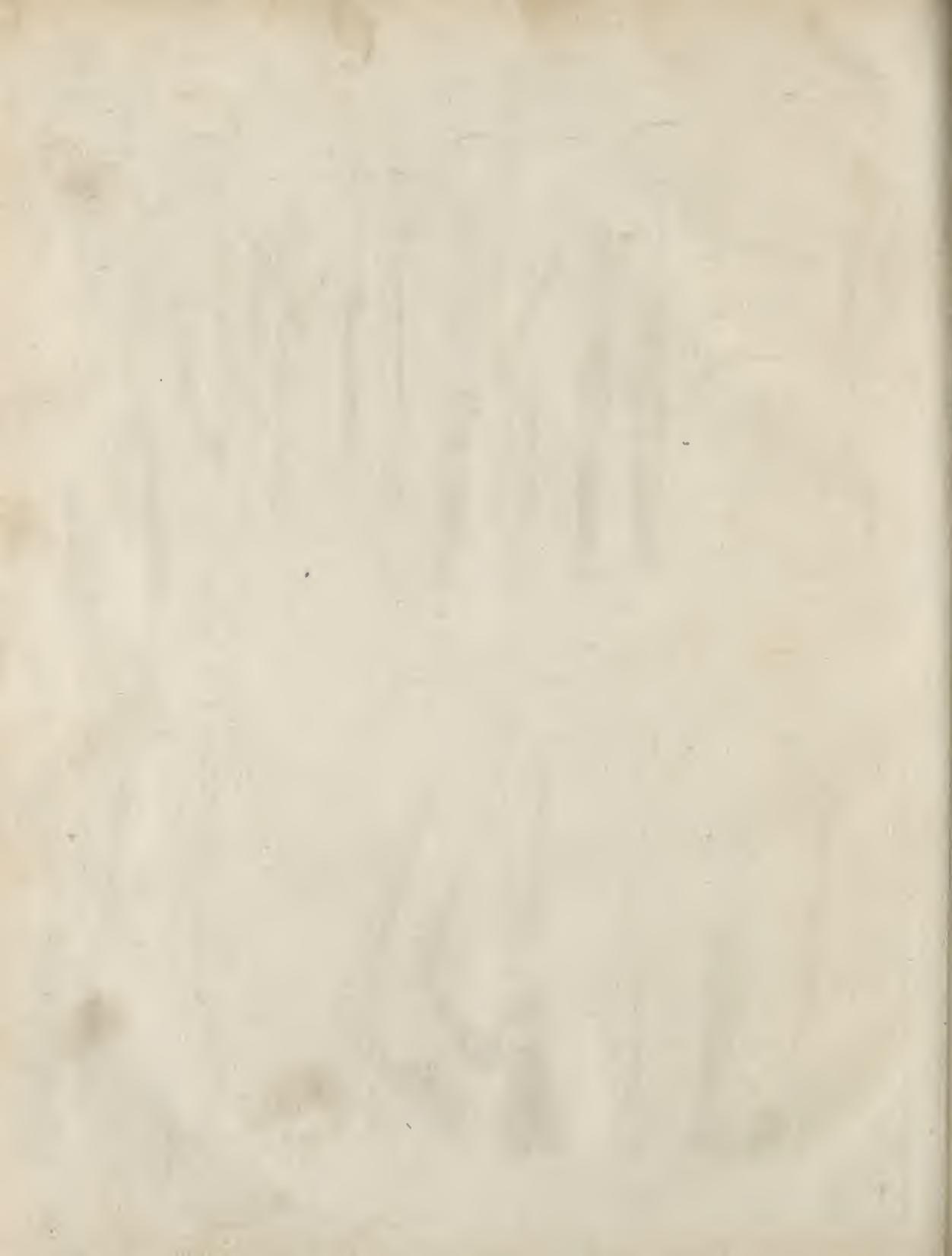
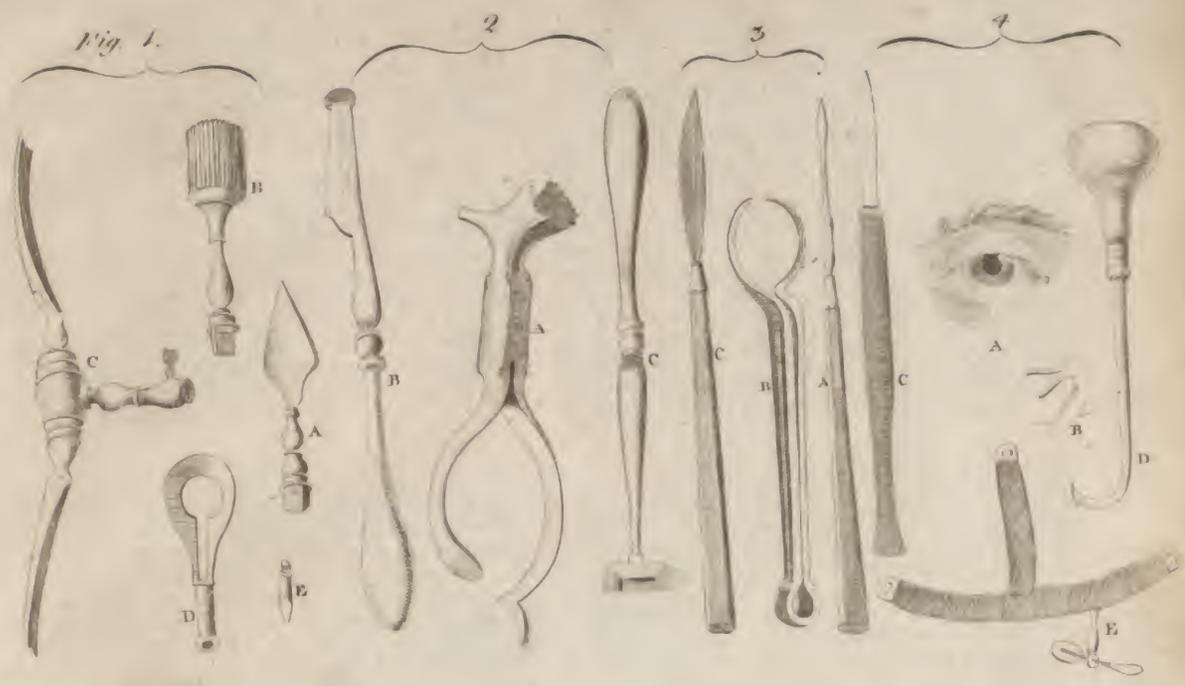
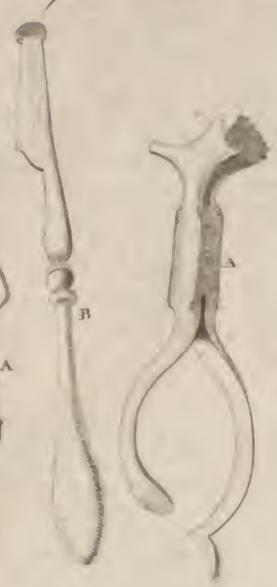


Fig. 1.



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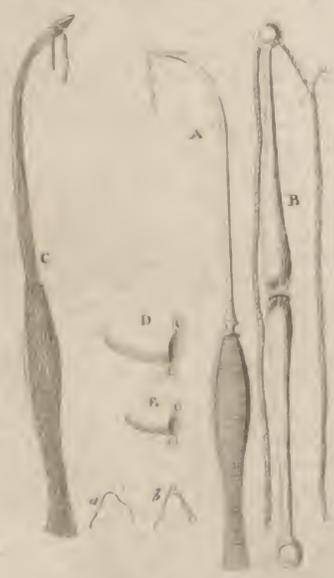
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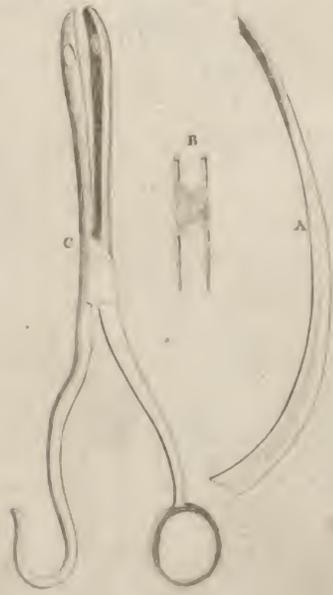
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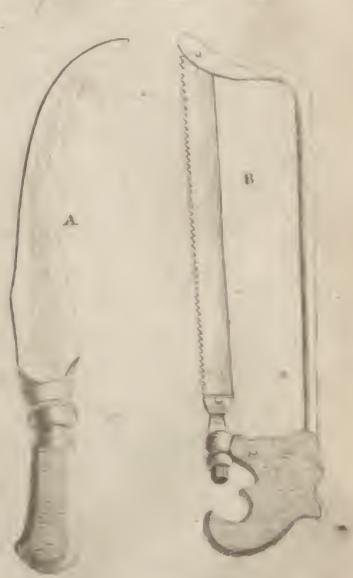
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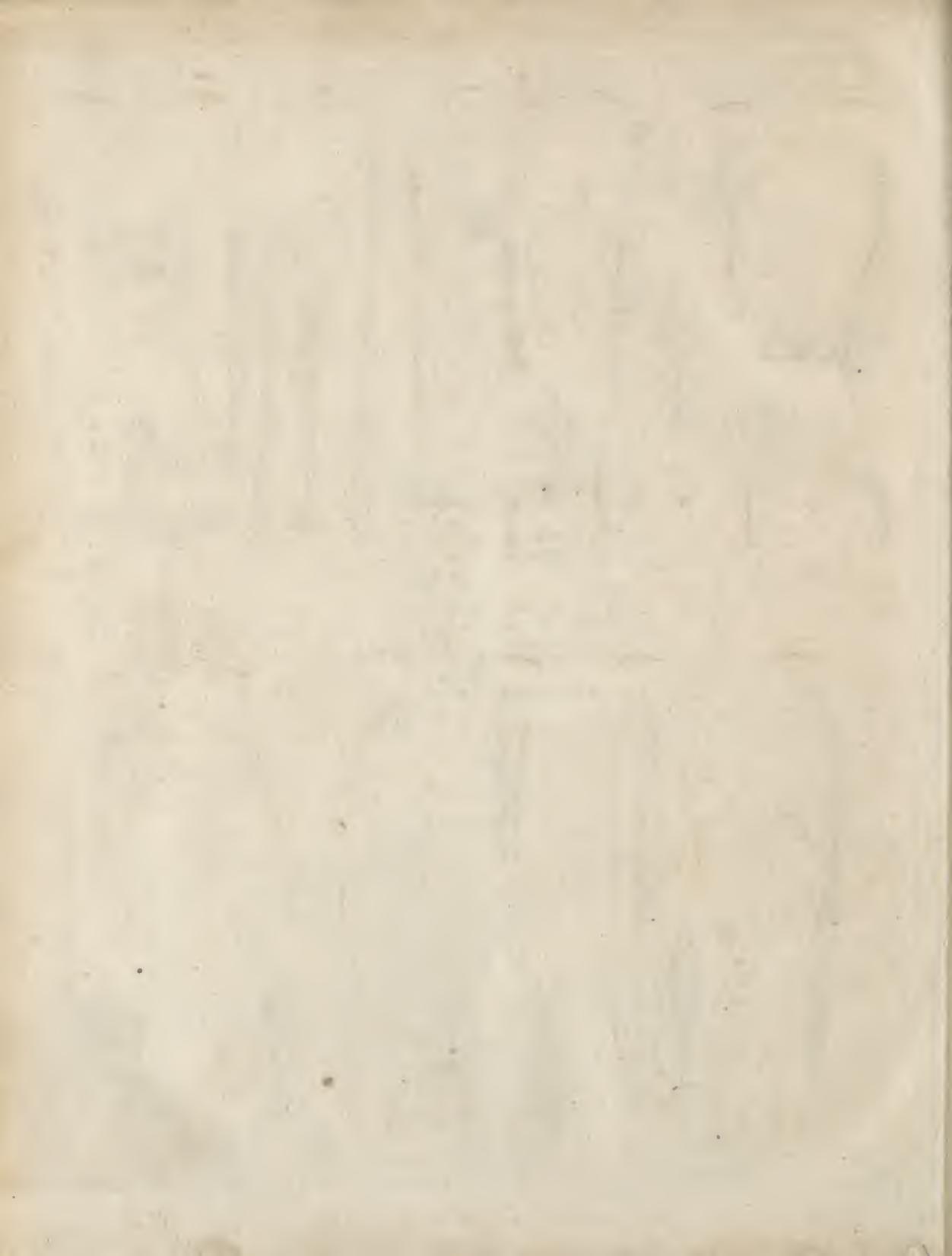


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restored to its natural place, and then properly bound up.

*Of a LUXATION of the FOOT and ANGLE.*

THE ankle may be sometimes luxated either in jumping, running, or walking; and that in all four directions, inward, outward, backward, and forward. Which of these ways it happens to be luxated, may be discovered by the particular posture of the joint.

The ankle is more or less difficult to reduce, in proportion to the violence of the cause by which it is luxated. But the most ready way of reducing a luxation of the ankle is to place the patient upon a bed, seat, or table, letting the leg and foot be extended in opposite directions by two assistants, while the surgeon strives to reduce the ankle with his hands and fingers. When the foot is by this means once replaced, it is proper to bind it up carefully, after it has been well bathed with *oxycrate* and salt, advising the patient to keep to his bed a good while, till the disorder and its symptoms quite leave him.

Sometimes it happens, that only the *os calcis* or *calcaneum* is luxated by some external force, and that either towards the internal or external side of the foot. Whichever way it happens, when there is pain and inequality of the member, that is, when it has a cavity in one part, and a tumour in another, there is strong reason to suppose a luxation: and as soon as it is discovered, the same method of cure is required with that before recited, keeping the limb quiet for some time afterwards.

Lastly, if any other bone in the foot, the *tarsus* or *metatarsus*, should happen to be luxated by some considerable external violence, the ligaments with the adjacent nerves and tendons are generally so affected as to excite not only most acute pains, but violent inflammations and convulsions; and even death itself has been observed to be the consequence, unless the bones were speedily replaced: it is therefore the safest way to reduce the luxations in these bones of the foot, by the method we before proposed for those of the hands, and that with the greatest expedition.

## S U S

## S W A

**SURIANA**, in botany, a genus of the decandria pentagynia class. The calix consists of six leaves; and the corolla of five petals; and there are five roundish seeds. There is but one species, a native of America.

**URINAM**, the capital of the Dutch settlements in Guiana, in South America: W. long. 56°, and N. lat. 6° 30'.

**SURMOUNTED**, in heraldry, is when one figure is laid over another. As the pile surmounted of a chevron in Plate CXLVII. fig. 17.

**SURREPTITIOUS**. See **SUBREPTITIOUS**.

**SURRY**, a county of England, bounded by the river Thames, which separates it from Middlesex, on the north; by Kent, on the east; by Suffex, on the south; and by Berkshire, on the west; being thirty-four miles long, and twenty-one broad.

**SURROGATE**, in law, denotes a person that is substituted, or appointed in the room of another.

**SURSOLID**, in arithmetick and algebra, the fifth power, or fourth multiplication of any number or quantity considered as a root. See **ARITHMETICK**, and **ALGEBRA**.

**SURVEYING**, the art or act of measuring land; that is, of taking the dimensions of any tract of ground, laying down the same in a map or draught, and finding the content or area thereof. See **GEOMETRY**, p. 699.

**SURVEYOR**, a person who hath the oversight and care of considerable works, lands, or the like.

**SURVEYOR** likewise denotes a gauger; as also a person who surveys lands, and makes maps of them.

**SURVIVOR**, in law, signifies the longest liver of joint-tenants, or of any two persons jointly interested in a thing.

**SUS**, in zoology, a genus of quadrupeds belonging to the order of belluae. They have four converging fore-teeth in the upper jaw, and six prominent ones in the under jaw; there are two short dog-teeth in the upper jaw, and one longer and jutting out in the under jaw; the snout is truncated, prominent, and moveable. There are five species. The *fus scrofa*, or common sow, is a native of the southern parts of Europe. It feeds coarsely, digs up roots, &c. from the ground with its snout. It is a

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fat, sleepy, stupid, dirty animal, wallowing constantly in the mire. The sow brings forth a great number of young at a litter, and is therefore considered as a profitable animal. The flesh, however, is not reckoned to be of the most wholesome kind.

**SUSDAL**, a city of the province of Moscow, in Russia, one hundred miles north-east of Moscow.

**SUSPENSION**, or *Points of SUSPENSION*, in mechanics, are those points in the axis or beam of a balance, wherein the weights are applied, or from which they are suspended. See **MECHANICS**.

**SUSPENSION of Arms**, in war, a short truce agreed on by both armies, in order to bury the dead, wait for fresh instructions, or the like.

**SUSPENSION**, in Scots law. See **LAW**, Tit. xxxii. 4.

**SUSSEX**, a county of England, bounded by Surrey and Kent on the north, by another part of Kent on the east, by the English channel on the south, and by Hampshire on the west: being sixty-five miles long, and twenty-nine broad.

**SUTHERLAND**, a shire of Scotland, bounded by Caithness on the north, by the German sea on the east, by Roxshire on the south, and by the Caledonian ocean on the west and north-west.

**SUTTON GOLEFIELD**, a market-town twenty miles north-west of Warwick.

**SUTURE**, in anatomy. See **ANATOMY**, p. 152.

**SUTURE**, in surgery, a method of uniting the lips of wounds. See **SURGERY**, p. 650.

**SWABBER**, an inferior officer on board ships of war, whose employment it is to see that the decks are kept neat and clean.

**SWABIA**, a circle of the German empire, bounded by Franconia and the palatinate of the Rhine on the north, by Bavaria on the east, by Switzerland and Tyrol on the south, and by the river Rhine, which separates it from Alsatia, on the west; being one hundred and thirty miles long, and one hundred and ten broad.

**SWALE**, a river of Yorkshire, which rising on the confines of Westmorland, runs south-east through Yorkshire, and falls into the Ouse.

8 I

SWAL-

**SWALLOW**, in ornithology. See **HIRUNDO**.

**SWALLOW-WORT**, in botany. See **ASCLEPIAS**.

**SWAN**, in ornithology. See **ANAS**.

**SWEAT**, a sensible moisture issuing out of the pores of the skins of animals. See **PERSPIRATION**.

**SWEDEN**, one of the most northerly kingdoms of Europe, bounded by Norwegian Lapland on the north, by Russia on the east, by the Baltic sea on the south, and by Norway on the west; being upwards of eight hundred miles from north to south, and five hundred from east to west.

**SWEEP**, in the sea-language, is that part of the mould of a ship, where she begins to compass in at the rung-heads: also, when the hawser is dragged along the bottom of the sea, to recover any thing that is sunk, they call this action sweeping for it.

**SWEET**, in the wine-trade, denotes any vegetable juice, whether obtained by means of sugar, raisins, or other foreign or domestic fruit, which is added to wines, with a design to improve them.

**SWERIN**, a town of lower Saxony, in Germany, capital of the duchy of Mecklenburg, and situated on the lake of Swerin: in E. long. 11° 30', and N. lat. 54°.

**SWERTIA**, in botany, a genus of the pentandria digynia class. The corolla is rotated, and there are nectariferous pores at the bases of the different lacinæ of the corolla; the capsule has one cell, and two valves. There are five species, only one of them, *viz.* the perennis, or marsh gentian, a native of Britain.

**SWIMMING**, the art or act of sustaining the body in water, and of moving therein; in which action the air-bladder and fins of fishes bear a considerable part.

Though a great deal depends on the motion of the muscles of the several parts of the body, in the swimming of the fish; yet the tail, and those muscles which move the lower part of the body to which it is affixed, are the great instruments by which their swift motions in the water are performed. The moving the tail, and that part of the body to which it adheres, backward and forward, or sideways any one way, throws the whole body of the fish strongly the contrary way; and even in swimming straight forward, the motion and direction are both greatly assisted by the vibrations of this part, as may be experienced in the motion of a boat, which, when impelled forward, may be firmly guided by means of an oar held out at its stern, and moved in the water as occasion directs. The dorsal muscles, and those of the lower part of the body between the anus and tail, are the principal that are used in the motion of this part, and these are therefore the most useful to the fish in swimming. The muscles of the belly seem to have their principal use in the contracting the belly and the air-bladder. They have been supposed of use to move the belly-fins; but there are too many of them for such a purpose, and these fins have each its peculiar muscle fully sufficient to the business. The use of the tail in swimming is easily seen, by cutting it off, and committing the fish to the water without it, in which case it is a most helpless creature.

By the help of the tail they also turn about, by striking strongly with it on one side, and keeping it bent, so as to act like the rudder of a ship. The fins, especially the pectoral ones, serve to keep the fish upright, as also to ascend and descend.

Brutes swim naturally; but men attain this art by prac-

tice and industry. It consists principally in striking alternately with the hands and feet; which, like oars, row a person forward: he must keep his body a little oblique, that he may the more easily erect his head, and keep his mouth above water.

**SWINE**, in zoology. See **SUS**.

**SWINGLING**, the beating of flax or hemp. See **FLAX**.  
**SWITZ**, the capital of one of the cantons of Switzerland, to which it gives name, situated on the east side of the lake Lucern, sixteen miles south-east of the city of Lucern: E. long. 8° 30', and N. lat. 47°.

**SWITZERLAND**, or **SWISSERLAND**, called Helvetia by the Romans, is surrounded by the territories of Germany, France, and Italy, being about two hundred and sixteen miles long, and upwards of one hundred miles broad.

**SWORD**, an offensive weapon, worn at the side, and serving either to cut or stab: its parts are the handle, guard, and blade; to which may be added the bow, scabbard, pommel, &c.

**SWORD-FISH**. See **XIPHIAS**.

**SYCAMORE-TREE**, in botany. See **ACER**.

**SYCOPHANT**, an appellation given by the ancient Athenians to those who informed of the exportation of figs, contrary to law; and hence it is still used in general for all informers, parasites, flatterers, cheats, &c.

**SYLLABLE**, in grammar, a part of a word, consisting of one or more letters, pronounced together.

**SYLLABUS**, in matters of literature, denotes a table of contents, or an index of the chief heads of a book or discourse.

**SYLLOGISM**, in logic, an argument or term of reasoning, consisting of three propositions; the two first of which are called premisses, and the last the conclusion. See **LOGIC**, p. 991.

**SYMBOL**, a sign or representation of something moral, by the figures or properties of natural things.

Hence symbols are of various kinds, as hieroglyphics, types, ænigmas, parables, fables, &c.

Among Christians, the term symbol denotes the Apostles creed.

**SYMMETRY**, the just proportion of the several parts of any thing, so as to compose a beautiful whole.

**SYMPATHETIC**, something that acts, or is acted on, by sympathy: thus we say, sympathetic diseases, inks, powders, &c.

**SYMPATHY**, in medicine, denotes an indisposition befalling one part of the body, through the defect or disorder of another; whether it be from the affluence of some humour, or vapour sent from elsewhere; or from the want of the influence of some matter necessary to its action.  
**SYMPHONY**, in musick, properly denotes a consonance or concert of several sounds agreeable to the ear, whether vocal or instrumental, called also harmony.

**SYMPHYSIS**, in anatomy. See **ANATOMY**, p. 148.

**SYMPHYTUM**, in botany, a genus of the pentandria monogynia class. The limbus of the corolla is tubular and somewhat ventricose, the fauces being closed with subulata radii. There are three species, only one of them, *viz.* the officinale, or comfrey, a native of Britain. The root of the comfrey is a fine mucilage.

**SYMPOSIARCH**, in antiquity, the director, or manager of an entertainment. This office was sometimes performed by the person at whose charge the entertainment was provided.

provided; sometimes by another named by him; and at other times, especially in entertainments provided at the common expence, he was elected by lot, or by the suffrages of the guests.

**SYMPTOM**, in medicine, any appearance in a disease, which serves to indicate or point out its cause, approach, duration, event, &c.

**SYMPTOMATICAL**, in medicine, is a term often used to denote the difference between the primary and secondary causes in diseases: thus a fever from pain is said to be symptomatical, because it rises from pain only.

**SYNÆRESIS**, contraction, in grammar, a figure whereby two syllables are united in one; as *veniens* for *vehemens*.

**SYNAGOGUE**, a particular assembly of Jews met to perform the offices of their religion. Also the place wherein they meet.

**SYNALOEPHA**, in grammar, a contraction of syllables, performed principally by suppressing some vowel or diphthong at the end of a word, on account of another vowel or diphthong at the beginning of the next. As *ill' ego*, for *ille ego*, &c.

**SYNARTHROSIS**, in anatomy. See **ANATOMY**, p. 148.

**SYNCHONDROSIS**, in anatomy. See **ANATOMY**, p. 148.

**SYNCHRONISM**, denotes the happening of several things in the same time.

**SYNCOPATION**, in musick, denotes a striking or beating of time, whereby the distinction of the several times or parts of the measure is interrupted.

**SYNCOPE**, **FAINING**, in medicine, a deep and sudden swooning, wherein the patient continues without any sensible heat, motion, sense, or respiration, and is seized with a cold sweat over the whole body, and all the parts turn pale and cold as if dead. See **MEDICINE**, p. 157.

**SYNCOPE**, in grammar, an elision or retrenchment of a letter or syllable out of the middle of a word, as *calidus* for *calidus*.

**SYNDIC**, in government and commerce, an officer in divers countries intrusted with the affairs of a city, or other community, who calls meetings, makes representations and solicitations to the ministry, magistracy, &c. according to the exigency of the case.

**SYNDROME**, a word introduced into medicine by the empirics, who mean by it a concurrence of symptoms.

**SYNECDOCHE**, in rhetoric, a kind of trope, frequent among orators and poets. There are three kinds of *synecdoches*. By the first, a part is taken for the whole; as the point for the sword, the roof for the house, the sails for the ship, &c. By the second, the whole is used for a part. By the third, the matter whereof the thing is made is used for the thing itself; as steel for sword, silver for money, &c. To which may be added another kind, when the species is used for the genus, or the genus for the species.

**SYNECDOCHE**, in Greek and Latin grammar, is when the ablative of a part or an adjunct of a sentence is changed into the accusative.

**SYNECOPHONESIS**, in grammar, a coalition whereby two syllables are pronounced as one.

**SYNGENESIA**, in botany. See **BOTANY**, p. 635.

**SYNNEUROSIS**, in anatomy. See **ANATOMY**, p. 148.

**SYNOCHUS**, or **SYNOCHA**, in medicine, a continual fever, without any remission. See **MEDICINE**, p. 79.

**SYNOD**, in astronomy, a conjunction, or concurrence of two

or more stars, or planets, in the same optical place of the heavens.

**SYNOD**, signifies also a meeting, or assembly of ecclesiastical persons, concerning matters of religion.

**SYNODALS**, were pecuniary rents, commonly of two shillings, paid to the bishop, or archdeacon, at the time of their Easter visitation, by every parish priest.

**SYNODICAL**, something belonging to a synod: thus synodical epistles are circular letters written by the synods to the absent prelates and churches, or even those general ones directed to all the faithful, to inform them of what had passed in the synod.

**SYNOECIA**, in Grecian antiquity, a feast celebrated at Athens, in memory of Theseus's having united all the petty communities of Attica into one single commonwealth, the seat whereof was Athens, where all the assemblies were to be held. This feast was dedicated to Minerva; and, according to the scholiast of Thucydides, it was held in the month *Metagitæon*.

**SYNONYMOUS**, is applied to a word or term that has the same import or signification with another.

**SYNOVIA**, in medicine, a term used by Paracelsus, and his school, for the nutritious juice proper and peculiar to each part; thus they talk of the synovia of the joints, of the brain, &c.

**SYNTAX**, in grammar, the proper construction, or due disposition of the words of a language, into sentences, or phrases. See **GRAMMAR**.

**SYNTEXIS**, in medicine, an attenuation, or colliquation of the solids of the body, such as frequently happens in atrophies, inflammations of the bowels.

**SYNTHETIC**, or **SYNTHETICAL** is, according to Dr. Shaw, a term given to that part of chemistry, which, after the analytical chemistry has taken bodies to pieces, or reduced them to their principles, can, from these separated principles, either recompound the same body again, or, from the mixtures of the principles of one or more bodies in various manners, form a large set of new productions, which would have been unknown to the world but for this art: such productions are brandy, soap, glass, and the like.

**SYNUSIASTS**, a sect of heretics, who maintained, that there was but one nature and one single substance in Jesus Christ.

**SYRACUSE**, a city and port-town of Sicily, in the province of Val de Noto, situated on a fine bay of the Mediterranean sea, on the east coast of the island: in E. long 15° 5', N lat. 37° 25'.

**SYRIA**, a part of Asiatic Turkey, bounded by Natolia and Turcomania, on the north; by Diarbec or Mesopotamia on the east; by Arabia and Palestine on the south; and by the Levant-sea on the west. The Turks divide Syria into three beglerbeglies, or vice-royalties, *viz.* those of Aleppo, Tripoli, and Damascus, or Scham, the seats of the respective viceroys.

**SYRINGA**, in botany, a genus of the diandria monogynia class. The corolla consists of four segments, and the capsule has two cells. There are two species, both natives of Persia.

**SYRINGE**, a well known instrument, serving to imbibe or suck in a quantity of fluid, and to squirt or expel the same with violence.

A syringe is only a single pump, and the water ascends

in it on the same principle as in the common sucking pump. See *HYDROSTATICS*, p. 808.

**SYRUP**, in pharmacy, a saturated solution of sugar, made in vegetable decoctions, or infusions.

**SYSSARCOISIS**, in anatomy. See *ANATOMY*, p. 148.

**SYSTEM**, in general, denotes an assemblage or chain of principles and conclusions, or the whole of any doctrine, the several parts whereof are bound together and follow or depend on each other; in which sense we say, a system of philosophy, a system of divinity, &c.

**SYSTOLE**, in anatomy, the contraction of the heart, whereby the blood is drawn out of its ventricles into the arteries; the opposite state to which is called the diastole, or dilatation of the heart.

**SYSTYLE**, in architecture, that manner of placing columns where the space between the two fusts consist of two diameters, or four modules.

**SYZYGY**, in astronomy, a term equally used for the conjunction and opposition of a planet with the sun. See *ASTRONOMY*.



## T.

### T A B

**TABAGO**, one of the Caribbee islands in the American ocean, one hundred and twenty miles south of Barbadoes: W. long. 59°, N. lat. 11° 30'.

**TABARCA**, an island on the coast of Barbary, in Africa, fifty miles west of Tunis: E. long. 8°, N. lat. 36° 30'.

**TABASCO**, the capital of a province of the same name, situated on the bay of Campeachy, at the mouth of the river tabasco, one hundred and sixty miles south-west of Campeachy: W. long. 95°. N. lat. 18°.

**TABBY**, in commerce, a kind of rich silk which has undergone the operation of tabbying. See the next article.

**TABBYING**, the passing a silk or stuff under a calender, the rolls of which are made of iron or copper, variously engraven, which bearing unequally on the stuff renders the surface thereof unequal, so as to reflect the rays of light differently, making the representation of waves thereon.

**TABELLA**, **TABLET**, in pharmacy, is much the same with troches and lozenges, being a solid preparation formed into a little cake, or mass, of different figures, intended to dissolve slowly, and generally made agreeable to the palate.

**TABELLIO**, in the Roman law, an officer or scrivener, much the same with our notaries-public, who are often called tabelliones in our ancient law-books.

**TABERNACLE**, among the Hebrews, a kind of building, in the form of a tent, set up, by express command of God, for the performance of religious worship, sacrifices, &c. during the journeying of the Israelites in the wilderness; and, after their settlement in the land of Canaan, made use of for the same purpose till the building of the temple of Jerusalem. It was divided into two parts, the one covered, and properly called the tabernacle; and the other open, called the court. The curtains which covered the tabernacle were made of linen, of several colours, embroidered. There were ten curtains, twenty-eight cubits long and four in breadth. Five curtains fastened together made up two coverings, which covered all the tabernacle. Over these there were two other coverings; the one of goat-hair, and the other of sheep skins. The holy of holies was parted from the rest of the tabernacle by a curtain made fast to four pillars, standing ten cubits from the end. The length of

### T A B

the whole tabernacle was thirty-two cubits, that is, about fifty feet; and the breadth twelve cubits, or nineteen feet. The court was a spot of ground one hundred cubits long, and fifty in breadth, inclosed by twenty columns, each twenty cubits high and ten in breadth, covered with silver, and standing on copper bases, five cubits distant from one another; between which, there were curtains drawn, and fastened with hooks: At the east end was an entrance, twenty cubits wide, covered with a curtain hanging loose.

*Feast of* **TABERNACLES**, a solemn festival of the Hebrews, observed after harvest, on the fifteenth day of the month Tisri, instituted to commemorate the goodness of God, who protected the Israelites in the wilderness, and made them dwell in booths, when they came out of Egypt. On the first day of the feast, they began to erect booths of the boughs of trees, and in these they were obliged to continue seven days. The booths were placed in the open air, and were not to be covered with cloths, nor made too close by the thickness of the boughs; but so loose that the sun and the stars might be seen, and the rain descend through them.

**TABERNÆMONTANA**, in botany, a genus of the pentandria monogynia class. It has two horizontal follicles; and the seeds are pulposus. There are three species, all natives of America.

**TABES**, or **CONSUMPTION**. See *MEDICINE*, p. 103.

**TABLATURE**, in musick, is, in general, when, to express the sounds or notes of a composition, we use the letters of the alphabet, or any other characters not used in the modern musick.

*Laws of the twelve* **TABLES**, were the first set of laws of the Romans, thus called, either by reason the Romans then wrote with a style on thin wooden tablets covered with wax; or rather, because they were engraven on tables, or plates of copper, to be exposed in the most noted part of the public forum. After the expulsion of the kings, as the Romans were then without any fixed or certain system of law, at least had none ample enough to take in the various cases that might fall between particular persons, it was resolved to adopt the best and wisest laws of the Greeks. One Hermodorus was first appointed

to translate them, and the decemviri afterwards compiled and reduced them into ten tables. After a world of care and application, they were at length enacted and confirmed by the senate and an assembly of the people, in the year of Rome 303. The following year they found something wanting therein, which they supplied from the laws of the former kings of Rome, and from certain customs which long use had authorized: all these being engraven on two other tables, made the laws of the twelve tables, so famous in the Roman jurisprudence, the source and foundation of the civil or Roman law.

**TABLES of the law**, in Jewish antiquity, two tables on which were written the decalogue, or ten commandments, given by God to Moses on Mount Sinai. See **DECALOGUE**.

**TABLE**, in mathematics, a system of numbers calculated to be ready at hand for the expediting astronomical, geometrical, and other operations.

**Astronomical TABLES**, are computations of the motions, places, and other phenomena of the planets.

**TABORITES**, a branch or sect of the ancient Hussites. They carried the point of reformation farther than Huss had done, rejected purgatory, auricular confession, the union of baptism, transubstantiation, &c. They reduced the seven sacraments of the Romanists to four, *viz.* baptism, the eucharist, marriage, and ordination.

**TABRISTAN**, a province of Persia, situated on the northern shore of the Caspian sea, having the province of Astrabat on the east, and Gilan on the west; being part of the ancient Hyrcania.

**TACAMAHACA**, in pharmacy, a solid resin, improperly called a gum, in the shops: it is of a fragrant and peculiar smell, and is of two kinds; the one called the shell-tacamahaca, which is the finest; the other, which is an inferior kind, being termed rough-tacamahaca, or *tacamahaca* in grains.

Some greatly commend *tacamahaca* in disorders of the breast and lungs; but, at present it is very rarely used internally. Externally, however, it is in repute for softening tumours, and mitigating pain and aches.

**TACK**, in a ship, a great rope having a wale-knot at one end, which is seized or fastened into the clew of the sail; so is reefed first through the chesse-trees, and then is brought through a hole in the ship's side. Its use is to carry forward the clew of the sail, and to make it stand close by a wind: and whenever the sails are thus trimmed, the main-tack, the fore-tack, and mizen-tack, are brought close by the board, and haled as much forward on as they can be.

**TACK**, in Scots law. See **LAW**, Tit. xiii. 8, &c.

**TACK-ABOUT**, in the sea-language, is to turn the ship about, or bring her head about, so as to lie the contrary way.

**TACKLE**, among sea-men, denotes all the ropes or cordage of a ship, used in managing the sails, &c.

**TACTICS**, in the art of war, is the method of disposing forces to the best advantage in order of battle, and of performing the several military motions and evolutions.

**TADCASTER**, a market-town of Yorkshire, ten miles south west of York.

**TADORNA**, in ornithology. See **ANAS**.

**TADPOLE**, a young frog, before it has disengaged itself

from the membranes that envelope it in its first stage of life. See **RANA**.

**TÆNIA**, in zoology, a genus of insects, belonging to the order of vermes zoophyta; the body of which is of an oblong form, and composed of evident joints or articulations, in the manner of the links of a chain, with a mouth and viscera in each joint; so that the joints, which are exceedingly numerous, are in some measure so many distinct animals, and can live independent of each other. There are four species; the solium, or tape-worm, is found in the bowels of men, and fishes, and frequently extends to many yards in length. See **MEDICINE**, p. 160.

**TÆNIA**, in architecture, a member of the Doric capital, resembling a square fillet, or reglet: it serves instead of a cymatium.

**TAFETY**, in commerce, a fine smooth silken stuff, remarkably glossy.

**TAGETES**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is naked; the pappus has five straight awns; the calix consists of one tubulous leaf with five teeth; and there are five persistent floscules in the radius. The species are three, all natives of America.

**TAGUS**, the largest river of Spain; which, taking its rise on the confines of Arragon, runs south-west through the provinces of New Castile and Estremadura; and passing by the cities of Aranjuez, Toledo, and Alcantara, and then crossing Portugal, forms the harbour of Lisbon, at which city it is about three miles over; and about eight or ten miles below this, it falls into the Atlantic ocean.

**TAJACU**, in zoology, a species of hog. See **SUS**.

**TAIL**, the train of a beast, bird, or fish; which, in land animals, serves to drive away flies, &c. and in birds and fishes, to direct their course, and assist them in ascending or descending in the air or water.

**TAILZIE**, in Scots law. See **LAW**, Tit. xxvii. 8, &c.

**TAINÉ**, a port-town of Ross-shire, in Scotland, situated on the south-side of the frith of Sutherland, seven miles north of Cromarty: W. long. 3° 38', N. lat. 58°.

**TALC**, in natural history, a large class of fossil bodies, composed of broad, flat, and smooth laminæ or plates, laid evenly and regularly on one another; easily fissile, according to the site of these plates, but not all so in any other direction; flexible, and elastic; bright, shining, and transparent; not giving fire with steel, nor fermenting with acid menstrua, and sustaining the force of a violent fire without calcining.

**TALENT**, money of account among the ancients.

Among the Jews, a talent in weight was equal to 60 maneh, or 113 lb. 10 oz. 1 dwt. 10 $\frac{1}{2}$  gr.

**TALIO**, *lex talionis*, a species of punishment in the Mosaic law, whereby an evil is returned similar to that committed against us by another; hence that expression, eye for eye, tooth for tooth.

**TALISMANS**, magical figures cut or engraved with superstitious observations on the characteristics and configurations of the heavens, to which some astrologers have attributed wonderful virtues, particularly that of calling down celestial influences. The talismans of Samothrace, so famous of old, were pieces of iron formed into certain images, and set in rings; these were esteemed preservatives

- rives against all kinds of evils. There were likewise tallowmen taken from vegetables, and others from minerals.
- TALLOW**, in commerce, the fat of certain animals, melted down and clarified, so as to be fit for making candles, &c.
- TALLOW-TREE**, a remarkable tree growing in great plenty in China; so called, from its producing a substance like tallow, which serves for the same purpose: it is about the height of a cherry-tree, its leaves in form of a heart, of a deep shining red colour, and its bark very smooth. Its fruit is inclosed in a kind of pod, or cover, like a chestnut, and consists of three round white grains, of the size and form of a small nut, each having its peculiar capsula, and within a little stone. This stone is encompassed by a white pulp which has all the properties of true tallow, both as to consistence, colour, and even smell; and accordingly the chinese make their candles of it; which would doubtless be as good as those in Europe, if they knew how to purify their vegetable, as well as we do our animal, tallow.
- TALLY**, a piece of wood cut in two parts, whereon accounts were anciently kept, by means of notches; one part of the tally being kept by the debtor, and the other by the creditor.
- TALMUD**, among the Jews, a collection of the doctrines of their religion and morality. It is the *corpus juris*, or body of the laws and customs of the Jews, who esteem it equal to the scriptures themselves.
- TALPA**, in zoology, a genus of quadrupeds belonging to the order of feræ. There are six fore-teeth in the upper-jaw, and eight in the under-jaw; they have one large dog-tooth, and four smaller ones. There are two species, *viz.* the caudata, or common mole, with a tail, and five toes on the feet; it is a native of Europe, feeds upon worms, and, by raising the earth, infests gardens and cultivated grounds. This animal has a penis much longer, in proportion to the size of its body, than any other creature. The fur is exceedingly smooth and fine. Though generally believed to be blind, it has a couple of small eyes mostly hid with hair. 2. The *ascatica* has no tail, and but three toes on its feet. It is a native of Siberia.
- TAMANDAU**, in zoology. See *MYRMECOPHAGA*.
- TAMARINDUS**, in botany, a genus of the triandria monogynia class. The calix consists of four segments, and the corolla of three petals; the nectarium consists of two short bristles under the filaments; and the pod is pulpy. There is but one species, a native of Ægypt, Arabia, &c.
- The pod is made up of a double rind, or membrane, between which is a pulpy matter; which taken in the quantity of two or three drams, or an ounce or more, proves gently laxative or purgative; and at the same time,
- by its acidity, quenches thirst, and allays immoderate heat.
- TAMARIX**, in botany, a genus of the pentandria trigynia class. The calix consists of five segments, and the corolla of five petals: the capsule has one cell, and three valves; and the seeds are pappous. There are two species, none of them natives of Britain.
- The bark and leaves of the tamarix-tree are moderately astringent.
- TAMBAC**, a mixture of gold and copper, which the people of Siam hold more beautiful, and set a greater value on, than gold itself.
- TAMUS**, in botany, a genus of the diœcia hexandria class. The calix of both male and female consists of six segments; neither of them have any corolla; the stylus is trifid; and the berry has three cells, containing two seeds. There are two species, none of them natives of Britain.
- TAMWORTH**, a borough of Staffordshire, situated twenty miles south-east of Stafford. It sends two members to parliament.
- TAN**, the bark of the oak, chopped and ground in a tanning-mill into a coarse powder, to be used in the tanning of leather. See *TANNING*.
- TANACETUM**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; and the calix is hemispherical and imbricated. There are eight species, only one of them, *viz.* the vulgare, or common tanfy, a native of Britain.
- Tanzy, considered as a medicine, is a moderately warm bitter, and is much extolled by some in hysteric complaints, especially if proceeding from a deficiency or suppression of the uterine purgations: its seeds and leaves have been in considerable esteem as anthelmintics; and are said to be good in colics and flatulencies.
- TANGENT** of an arch is a right-line drawn perpendicularly from the end of a diameter, passing to one extremity of the arch, and terminated by a right-line drawn from the centre through the other end of the arch, and called the secant. See *GEOMETRY*.
- TANGIER**, a port-town of Africa, in the empire of Morocco and kingdom of Fez, situated at the entrance of the straits of Gibraltar, in W. long. 7°, N. lat. 35° 40'. It was the capital of the ancient Mauritania Tingitana, and was once in the possession of the English.
- TANGUT**, a province of Chinese Tartary, situated north-west of the great wall which divides Tartary from China.
- TANJOUR**, a city of the hither India, capital of a province of the same name, situated E. long. 79°, N. lat. 11° 30'.
- TANNER**, one who dresses hides, &c. by tanning them. See the next article.

## T A N N I N G.

**TANNING** is the art of preparing raw hides or skins for the hand of the currier; or for immediate use, without any further operation.

The first part of this definition includes all leather used

for the upper part of shoes, coaches, coach-barnets, saddle-leather, &c. and the last, the manufacture of bin or backs, &c.

We shall first give a general account of the process of manu-

manufacturing leather comprehended under the first part of the definition; and then explain separately the particular operations comprehended under the general process.

When the hide or skin is received raw from the hand of the butcher, it is thrown into a water-dub or other piece of water, to cleanse it from the blood and gore; after which, the horns and tail are cut off: then it is put into the lime, and wrought there according to the directions given below; from thence it is wrought into the bait, and cleaned there from the lime, &c. It is next transferred to the ooze; and when properly filled, according to the directions on that head, it is conveyed to the tann-pit, where it is tanned; which finishes the process.

Before we proceed, it will be necessary to give a short view of the nature and structure of leather, which will contribute to explain the reason of the different operations it passes through.

All hides or skins, when received from the hand of the butcher, are a bundle of connected tubes, somewhat resembling a honey-comb fixed on a basis; on the flesh-side, of an extreme close texture; but all open on the hair or grain side. These tubes contain a fatty or mucilaginous kind of matter; which, if allowed to remain in a fluid state, would corrupt the leather, and, if dried in the hide, would not only occasion a crisp or hardness in the leather, and be easily softened by moisture; but would also, in the course of tanning, in a great measure oppose every substance that can be applied to consolidate and preserve the hide from corruption.

To extract this matter; to swell and expand the pores as much as they can bear, without a disunion of parts, in order to increase the thickness, and the more easily to re-fill or introduce a matter less subject to changes from drought and moisture; to preserve the fibres that compose the leather from putrefaction; and to consolidate the whole into one durable mass; are the ends proposed by the several operations of tanning.

#### Of LIMING.

THE extraction of the matter contained in the pores being the first aim of the tanner, the first step is to open and expand the fibres, that the matter may be the more easily ejected, in order to give room for the subsequent reception of the tan. This is done by common slacked lime infused in water, and is made up in a pit built with stone, of a length sufficient to contain a mid-ding hide, but seldom so broad as to allow it to lie at its full breadth. The hides are generally treated in the lime in the following manner. They are thrown into a lime-dub, of a weak or slack consistence at first; where they are drawn out and thrown in twice or thrice every day, for a few days. They are then conveyed to a lime of a stronger quality, and drawn as before, though perhaps not so often; once in a day, or once in two days when they are further advanced, may suffice. After they have lain there for ten or fourteen days, the strength of the lime may be increased, or they may be carried to one of a stronger nature, where they are drawn and returned as before till they be completely limed.

As the hastening and retarding the operation in particular cases may be necessary; and as it is material for the quality of the leather, that the lime should make an equal impression upon the hide; or rather, if possible, that the weaker parts should be saved, and the stronger more exposed; the following observation may be of use. In most yards there

are from 20 to 40 hides or upwards wrought in a lime at a time. When these hides are all thrown in, they must necessarily be made to lie spread out upon one another, as close as possible, to take up little room. By this means those that are near the bottom of the pit will be squeezed so closely together by the pressure of the superior hides, that the water, the medium by which the lime is communicated to them, will be almost entirely excluded from acting upon the body of the hide, while the bellies and other outer skirts will be exposed to its full force. For this reason, it is necessary to change their position often, that the different parts of the hides may have nearly the same opportunity of being impregnated with the lime: and in this view, since drawing in the limes is necessary, it is also evident, that no prejudice can accrue to the leather from the frequent repetition of it, but may be greatly hurt if it is neglected. The often drawing of leather must not only bring on the operation more equally, but must at the same time quicken the effect of the lime, as the exposure of the hide to the air and lime by turns will give it an opportunity of acting with greater force. Besides, the workman has it in his power, every time the dub is drawn, either to add new strength to it (if necessary) by giving more lime, or to make it exert the strength it already possesses by stirring or raising the lime from the bottom. Thus the workman has it greatly in his power to accelerate or retard the operation as he shall think proper. Small leather ought to be drawn oftener than large, as it is not so able to resist the strength of the lime. During very hot weather the lime will operate more quickly than in cold: therefore the workman ought to pay a strict attention to the state of his limes at that time, and draw oftener. The rays of the sun, if allowed to act any time on the leather when it is in the draught, will greatly hurt it.

From the above hints, the workman will be enabled to form some judgment how to vary his work according to the different circumstances that may occur. And here it would seem requisite, that some directions should be given for knowing when the leather is sufficiently limed. But it is impossible to convey ideas in an intelligible manner by words, which can only be acquired by practice and frequent observation. Only we may observe in general, as the hide becomes limed, it leaves the original raw fleshy appearance, has more of the appearance of being boiled, and becomes more plump and spongy. But all these appearances are the more visible in proportion as the leather is over-done; and therefore it would be extremely dangerous for a person without experience to trust to the above marks. However, though the time taken to perform this operation may be much varied; yet the ordinary time for a middling hide is from 4 to 6 weeks, and so in proportion for larger and smaller leather.

#### Of BAITING, and other work before Oozing.

THE hide is now stripped of its hair, and all the slimy fatty stuff separated from the leather that is found adhering to the flesh-side; the first of which operations is called hairing, and the last fleshing. After which, as it is the workman's aim to discharge the matter contained in the pores of the leather, as also the particles of lime that may have insinuated themselves during the liming; and as the lime will be found to have communicated a degree of elasticity to the fibres, and a tenacious quality to the matter; it is necessary to unbrace and relax the fibres, and bring the matter

to be ejected into a greater state of fluidity before we attempt to repel it. An infusion of hen or pigeon dung and water, (which is called a bait,) has been found to be the most effectual thing for answering the above end. Into this infusion the hides are thrown promiscuously, where they are drawn in the same manner as directed in the article of liming; and in proportion to the draughts given, the strength of the leather, trim of the bait, &c. the workman will find his point gained from 4 to 8 days: he will find the leather reduced to a soft mellow consistence without any corruption or decay of parts, the matter more fluid and less tenacious, and easily separable from the hide upon working it on the beam with the tanners knife: but as once working cannot purify the hide, the workman must soak it in water, and work it on the beam, alternately, such a number of times as his judgment shall direct, in order to purge it thoroughly; and as it was observed before, that all the pores of the leather were open on the grain-side, most of the work should be applied on that side. As a putrefaction or corruption of the parts, or an extension of the fibres beyond their proper tone, can never be remedied when once begun, the over-doing or undue management either in baiting or liming, must be equally fatal. To obtain the ends proposed by these two operations, and at the same time to guard against their bad effects, require more experience and knowledge in the nature of leather than any other operation it has afterwards to go through.

#### Of Oozing.

THE hide, when ready for the ooze, ought to be nothing but a bundle of empty tubes void of all fluid matter; that is, composed of nothing but what is called the solids of the hide, without any decay or corruption.

It is now the tanner's business to fill these tubes or pores with a more durable matter, in order to support the fabric of the leather; which is the end of oozing. A number of different substances have been tried for this purpose; but none are equal to oak-bark. This bark, after it is thoroughly dried, is pounded, or rather bruised with a mill or other instrument; the powder is sifted out for the purpose of making up oozes, which is only an infusion of this powder in common water; an old or exhausted ooze (if not begun to corrupt) may be renewed by adding more bark, according to the strength of the ooze required. This liquor is deposited in a number of handlers or dusters, (as they are called,) as occasion requires, and the hides are thrown promiscuously into it, where they must be drawn and returned much in the same manner as directed in the article of liming, and carried from a weaker to a stronger ooze as the leather shall require, till they are found to be sufficiently filled. It will be found, that the finer particles of the bark will insinuate themselves into the pores of the leather, and lodge there; and at same time the astringent quality will strengthen and brace the fibres, and bring them again to their proper tone, after their relaxed state in the bait, which will make the leather appear to swell, and feel plump and soft. Here again no rule can direct an unexperienced person to know when a hide is properly oozed; and indeed some kinds of leather require a greater and some a lesser degree of it, according to the purpose for which it is intended; but in general, there is less danger in oozing plentifully than in being sparing of it, as it always adds to the weight and beauty of the leather. A middling hide may be oozed in three weeks,

and sooner or later in proportion to the strength of the ooze, the number of draughts, and heat of the weather.

#### Of LOPPING, or what is more properly called Tanning.

THIS part of the operation is designed to preserve the fibres from corruption, and at the same time to consolidate the whole into one compact body; or, in some sense, it may be called *lignifying* the hide, (if the term may be allowed.) This must evidently be the work of time, as the nature of the fibres must be in a great measure changed, and the new-imbibed matter incorporated and consolidated with them. In order to perform this, the hides are spread out at their full breadth and length in a vat, and a stratum of beat bark thrown betwixt each of them. This vat holds at first as much liquor as will just cover the hides; and in this situation they are allowed to lie till the strength of the bark is thought to be exhausted, which is commonly from four to six weeks; and the operation is repeated till the hides are sufficiently tanned, and which is generally from two to four times, according to the strength of the leather. The bark should be rounder beat, and more given to the lop, for large hides than small ones; and consequently larger leather should lie longer in the lop.

#### Of CURRYING.

THE leather, when only tanned, is not sufficiently soft and pliable to answer a number of purposes. The carrier's province is to reduce the leather to the proper thickness, pliability, and colour, requisite for the different uses to which it is applied: and though there is a material difference in the method of manufacturing the several kinds, and a good deal of dexterity required; yet what could be here said of them would be of little use to those who are unacquainted with the business. We shall therefore reduce all we are to say on this subject to a general detail of the process.

The leather, after it has dripped some time from the tan-pit, is shaven on an upright beam with a knife whose edge is turned on the one side, and with which the carrier can take down the leather in the same manner as a wright can take a shaving from a piece of wood with his plane. After the carrier has thus levelled the hide or skin to his purpose, (which is always done on the flesh-side,) he spreads it out on a stone or table made for the purpose, and there scours it on the grain-side from all the loose tan, and other stuff that may hurt the beauty of the grain. He then puts on a certain quantity of oil on both grain and flesh side, for the purpose of softening the fibres, and at the same time making them tough, and hangs it up to dry. When it is sufficiently dry, there is a thin shaving again taken off the flesh side, in order to clean or brighten it up; and then it is rubbed backward and forward upon a table by the carrier with a nicked or furrowed board, keeping the leather always doubled at the place where he rubs, till it be made soft and pliable to his intention. This last part of the operation is properly called *Currying*, and it is from this that the business gets its name. As to the colour, the leather is fair or dark in proportion to the quantity of oil laid on, if the tanning has been properly performed, and the carrier do not neglect some material part of his duty. Carriers seldom dye any colour but black, which is done with coperas and a very little logwood.

TANTALUS's CUP. See HYDROSTATICS, p. 808.

TANZY, in botany. See TANACETUM.

TAPE-WORM. See TÆNIA.

TAPESTRY, a curious kind of manufacture, serving to adorn a chamber or other apartment, by covering or lining the walls thereof. It is a kind of woven hangings of wool and silk, frequently raised and enriched with gold and silver, representing figures of men, animals, landscapes, histories, &c.

TAPPING, in general, the act of piercing an hole in a vessel, and applying a tube or canula in the aperture, for the commodious drawing off the liquors contained therein.

TAPPING, in surgery. See SURGERY, p. 655.

TAR, a thick, black, unctuous substance, obtained from old pines and fir-trees, by burning them with a close smothering heat: much used in coating and caulking ships, &c. See the article PITCH.

Water impregnated with the more soluble parts of tar, proves, in consequence of this hot pungent oil, warm and stimulating: it sensibly raises the pulse, and quickens the circulation. By these qualities, in cold, languid, phlegmatic habits, it strengthens the solids, attenuates viscid juices, opens obstructions of the minuter vessels, and promotes perspiration and the fluid secretions in general; whilst in hot bilious temperaments, it disposes to inflammation, and aggravates the complaints which it has been employed to remove.

TARACON, a city of Spain, in the province of Arragon, situated on the confines of Old Castile: W. long. 2° 6', and N. lat. 41° 55'.

TARAGON, a city and port-town of Spain, in the province of Catalonia, situated on the Mediterranean sea: in E. long. 1° 15', and N. lat. 41° 6'.

TARANTO, a port-town of Italy, in the kingdom of Naples, situated on the gulph of Otranto, forty-five miles west of that city, being the see of an archbishop.

TARANTULA, in zoology. See ARANEA.

TARE, is an allowance for the outside package, that contains such goods as cannot be unpacked without detriment; or for the papers, threads, bands, &c. that inclose or bind any goods imported loose; or, though imported in casks, chests, &c. yet cannot be unpacked and weighed nett.

TARENTAIS DUCHY, the south division of Savoy, having Piedmont on the south-east, and Savoy Proper on the north-west: subject to the king of Sardinia.

TARGET, a kind of shield or weapon of defence made use of by the ancients.

TARGUM, a name whereby the Jews call the Chaldee paraphrases, or expositions of the Old Testament in the Chaldee language. See BIBLE.

TARIF, a table of catalogue, containing the names of different sorts of merchandize, with the duties to be paid, as settled by authority, amongst trading nations.

TARPEIAN, in Roman antiquity, an appellation given to a steep rock in Rome: whence, by the law of the twelve tables, those guilty of certain crimes were precipitated.

TARSUS in anatomy. See ANATOMY, p. 185.

TARSUS, now Teraffo, once the capital of Cilicia, in the Lesser Asia, now a province of Asiatic Turkey, is situated on the north side of the Levant sea: E. long. 35°, N. lat. 37°.

TARTAR. See CHEMISTRY, p. 98, 165.

TARTARY a vast country in the northern parts of Asia, bounded by Siberia on the north and west: this is called

Great-Tartary. The Tartars who lie south of Moscow and Siberia, are those of Astracan, Circassia, and Dagistan, situated north-west of the Caspian sea; the Calmuc Tartars, who lie between Siberia and the Caspian-sea; the Usbec Tartars and Moguls who lie north of Persia and India; and, lastly, those of Tibet, who lie north-west of China.

TASSEL, a sort of pendant ornament at the corners of a cushion, or the like.

In building, tassels denote those pieces of board that lie under the ends of the mantlet-rees.

TASTE, in physiology, a peculiar sensation excited by means of the organs of taste, viz. the papillæ on the tongue. See ANATOMY, p. 304.

Intellectual TASTE The external sense, with which nature has furnished us, and by which we distinguish and relish the various kinds of nourishment that are adapted to health and pleasure, has in all languages given occasion to the metaphorical word *taste*, by which we express our perception of beauty, deformity, or defect in the several arts. *Taste* then, in general, is a quick discernment, a sudden perception, which, like the sensation of the palate, anticipates reflection; like the palate, it relishes what is good with an exquisite and voluptuous sensibility, and rejects the contrary with loathing and disgust; like the palate also, it is often doubtful, and, as it were, bewildered, not knowing whether it should relish or reject certain objects, and frequently requires the influence of habit to give it a fixed and uniform determination.

To have a taste, supposes something more than merely to perceive and to discern with accuracy the beauty of any work or object. This beauty must be *felt*, as well as *perceived*; the mind must be touched and affected by it in a lively and sensible manner. This feeling however, in order to constitute true *taste* must not be a vague and confused sensation; but must be attended with a distinct view, a quick and comprehensive discernment of the various qualities, in their several relations and connections, which enter into the composition of the object we contemplate. And in this we see another striking resemblance between the intellectual taste and the sensual one: for as a nice palate perceives immediately the mixture of different wines, so the man of taste will quickly discern the motley mixture of different styles in the same production; and, let the beauties and defects be ever so closely blended in an object, will always be capable of distinguishing the former from the latter.

As the corruption of the *sensual taste* discovers itself by a relish for only those delicate and high-seasoned dishes, in which all the refinements of art have been employed to excite a forced sensation of pleasure; so the depravity of the *intellectual taste* manifests itself by an attachment to far-fetched and studied ornaments, and by a want of relish for those beauties which are unaffected and natural. The corruption of the sensual taste, which makes us delight in such aliments as are disgusting to those whose organs are in a good state, is in reality a kind of disease; nor is that depravity of the intellectual taste which makes many prefer the *burlesque* to the *sublime*, and the laboured stiffness of art to the beautiful simplicity of nature, less a disease in our mental frame.

The intellectual *taste* is much more formed by education and culture, than the sensual one; for though the latter

latter may be brought, by habit, to relish what at first excited loathing and disgust; yet it does not seem to have been the intention of nature, that the generality of mankind should acquire by custom and experience those sensations and perceptions which are necessary to their preservation. It is otherwise with the *intellectual taste*: its formation requires time, instruction, and experience. A young man uninstructed in the arts of music and painting, let his natural sensibility be ever so quick and lively, will not immediately distinguish, in a grand concert of musick, the various parts whose connection and relation constitute the essence and charm of the composition; nor will he perceive in a picture the gradations of light and shade, that harmony of colours, that correctness of design, which characterise a finished piece; but in process of time, and also by degrees, he learns both to hear and to see in a more perfect manner. The same uninstructed person will find a variety of emotions arise in his mind the first time he is present at the representation of a fine tragedy: but he will neither perceive the dexterity of the author in maintaining the unities; nor that exquisite art by which the drama is so managed, that no person enters upon the scene nor quits it without an evident reason; nor yet that still more nice and difficult art of making the various subordinate interests terminate and centre in one, which absorbs them all. It is only by the force of habit and reflection, that he will distinguish these several objects of *taste*, and feel delightful sensations from circumstances of which formerly he had little or no idea.

Elegant and able artists may communicate their feelings and their discernment to others, and thus excite *taste* in a nation, which, without them, had never known its refined pleasures. By frequently contemplating the works of great and eminent masters in the various arts, the powers of nature arise into taste; and we imbibe, as it were, the spirit of these illustrious men, so as to come at length to look at a gallery of paintings with the eyes of a Le Brun, a Poussin, or a Le Sueur; nay, we even read works of learning and genius with a portion of that spirit that appears in their composition.

If, in the first periods of the culture of the arts and sciences, it has sometimes happened, that a whole nation have been unanimous in the praise of authors full of defects, and whom succeeding ages have beheld with indifference, and even with contempt; the reason is, that these authors had natural beauties which were perceived by all, while that just discernment that was necessary to distinguish their numerous defects, and which is less the gift of nature, than the result of time, habit, and reflection, was as yet acquired by none. Thus Lucilius, who had been in the highest reputation among the Romans, sunk into oblivion when Horace arose; and Regoier was universally admired by the French, until Boileau appeared; and if there are several ancient authors, who have maintained their credit, notwithstanding the absurdities that are to be found in every page of their writings, it must be the authors of those nations, among whom no judicious and correct writer has appeared to open their eyes, like Horace among the Romans, and Boileau among the French.

It is a common saying, that there is no disputing about tastes: and if by the *taste* here be understood the palate, which loaths certain aliments and relishes others, the maxim is just; because it is needless to dispute about what cannot

be corrected, or to attempt reforming the constitution and mechanism of organs merely corporeal. But the maxim is false and pernicious, when applied to that *intellectual taste* which has for its objects the arts and sciences. As these objects have real charms, so there is in reality a good taste which perceives them, and a bad one which perceives them not; and there are certain methods by which we may often correct those mental defects which produce a depraved *taste*. But it must be granted, at the same time, that there are certain phlegmatick spirits, which nothing can enflame; and also certain distorted intellects, which it is impossible to rectify: with such therefore, it is in vain to dispute about tastes, because they have none at all.

In many things taste seems to be of an arbitrary nature, and without any fixed or uniform direction, such as in the choice of dress and equipage, and in every thing that does not come within the circle of the finer arts. In this low sphere it should be distinguished by the name of *fancy*; for it is *fancy*, rather than *taste*, that produces such an endless variety of new and contradictory modes.

The taste of a nation may degenerate and become extremely depraved; and it almost always happens, that the period of its perfection is the forerunner of its decline. Artists, through the apprehension of being regarded as mere imitators, strike out into new and uncommon paths, and turn aside from the beautiful simplicity of nature, which their predecessors invariably kept in view. In these efforts there is a certain degree of merit, which arises from industry and emulation, and casts a veil over the defects which accompany their productions. The public, fond of novelty, applauds their invention; but this applause is soon succeeded by satiety and disgust. A new set of artists start up, invent new methods to please a capricious taste, and depart still further from nature than those who first ventured on its paths into the wilds of fancy. Thus the taste of a people degenerates into the grossest corruption. Overwhelmed with new inventions, which succeed and efface each other with incredible rapidity, they scarcely know where they are, and cast back their eager and anxious desires towards the period when *true taste* reigned under the empire of nature. But they implore its return in vain; that happy period cannot be recalled; it deposits, however, in the custody of certain choice spirits, the sublime pleasures of *true taste*, which they cherish and enjoy in their little circle, remote from the profane eye of the depraved and capricious multitude.

There are vast countries, where *taste* has not yet been able to penetrate. Such are those uncultivated wastes, where civil society has never been brought to any degree of perfection, where there is little intercourse between the sexes, and where all representations of living creatures in painting and sculpture are severely prohibited by the laws of religion. Nothing renders the mind so narrow, and so little, if we may use that expression, as the want of social intercourse; this confines its faculties, blunts the edge of genius, damps every noble passion, and leaves in a state of languor and inactivity every principle that could contribute to the formation of *true taste*. Besides, where several of the finer arts are wanting, the rest must necessarily languish and decay, since they are inseparably connected together, and mutually support each other. This is one reason, why the Asiatics have never excelled in any of the arts; and hence also it is that *true taste* has been confined to certain countries in Europe.

**TATA**, or **SINDA**, the capital of a province of the same name in the Hither India, in Asia, situated at the mouth of the Indus: E. long. 68°, N. 25° 40'.

**TAT-TOO**, a beat of a drum at night, to advertise the soldiers to retreat or repair to their quarters in their garri-son, or to their tents in a camp.

**TAU**, or **TAW**, in heraldry, an ordinary in figure of a T, supposed to represent St. Andrew's cross, or a cross po-tence, the top part cut off. See **CROSS**.

**TAVASTUS**, the capital of the province of Tavastia, in the territory of Finland in Sweden, situated eighty-four miles north-east of Abo: E. long. 24°, N. lat. 61° 20'.

**TAUGHT**, or **TAU'T**, in the sea-language, signifies the same as stiff, or fast: thus, to set taught the shrouds or stays, is to make them more tight and stiff.

**TAVISTOCK**, a borough of Devonshire, thirty-two miles west of Exeter.

It sends two members to parliament, and gives the title of marquis to the noble family of Ruffels dukes of Bedford.

**TAUNTON**, a borough of Somersetshire, twenty miles south-west of Wells. It sends two members to parliament.

**TAURIS**, or **TABRIS**, a city of Persia, four hundred miles north of Isfahan: E. long. 46° 30', N. lat. 38° 20'.

**TAURUS**, the **BULL**, in zoology. See **BOS**.

**TAURUS**, in astronomy. See **ASTRONOMY**, p. 847.

**TAUTOLOGY**, a needless repetition of the same thing in different words.

**TAWING**, the art of dressing skins in white, so as to be fit for divers manufactures, particularly gloves, &c.

All skins may be tawed: but those chiefly used for this purpose are lamb, sheep, kid, and goat skins.

The method of tawing is this: Having cleared the skins of wool or hair, by means of lime, they are laid in a large vat of wood or stone, set on the ground full of water, in which quick-lime has been slaked; wherein they are allowed to lie a month or six weeks, according as the weather is more or less hot, or as the skins are required to be more or less soft and pliant.

While they are in the vat, the water and lime is changed twice, and the skins are taken out and put in again every day; and when they are taken out for the last time, they are laid all night to soak in a running water, to get out the greatest part of the lime; and in the morning are laid together by sixes one upon another, upon the wooden leg (and are scraped stoutly one after another, to get the flesh off from the fleshy side, with a cutting two-handled instrument called a knife; and then they cut off the legs, (if they are not cut off before) and other superfluous parts about the extremities. Then they are laid in a vat or pit with a little water, where they are filled with wooden pestles, for the space of a quarter of an hour; and then the vat is filled up with water, and they are rinsed in it.

In the next place, they are thrown on a clean pave-ment to drain, and afterwards cast into a fresh pit of wa-ter, out of which they rinse them well, and are laid a-gain on the wooden leg, six at a time, with the hair-side outermost; over which they rub a kind of whetstone very briskly, to soften and fit them to receive four or five more preparations, given them on the leg, both on the flesh-

side and the hair-side, with the knife, after the manner above-mentioned.

After this they are put into a pit of water and wheaten-bran, and stirred about in it with wooden poles, till the bran is perceived to stick to them, and then they are left: as they rise of themselves to the top of the water by a kind of fermentation, they are plunged down again to the bottom; and at the same time fire is set to the liquor, which takes as easily as if it were brandy, but goes out the moment the skins are all covered.

They repeat this operation as often as the skins rise a-bove the water; and when they have done rising they take them out, lay them on the wooden leg, the fleshy side outwards, and pass the knife over them to scrape off the bran.

Having thus cleared them of the bran, they lay the skins in a large basket, and load them with huge stones to promote their draining: and when they have drained suf-ficiently, they give them their feeding, which is performed after the manner following:

For one hundred of large sheep-skins, and for smaller in proportion, they take eight pounds of alum, and three of sea-salt, and melt the whole with water in a vessel o-ver the fire, pouring the dissolution out, while yet luke-warm, into a kind of trough, in which is twenty pounds of the finest wheat flower, with the yolks of eight dozen of eggs; of all which is formed a kind of paste, a little thicker than children's pap; which, when done, is put into another vessel, to be used in the following manner.

They pour a quantity of hot water into the trough in which the paste was prepared, mixing two spoonfuls of the paste with it; to do which they use a wooden spoon, which contains just as much as is required for a dozen of skins: and when the whole is well diluted, two dozen of the skins are plunged into it; but they take care that the water be not too hot, which would spoil the paste and burn the skins.

After they have lain some time in the trough, they take them out, one after another, with the hand, and stretch them out; this they do twice; and after they have given them all their paste, they put them into tubs, and there fill them afresh with wooden pestles.

Then they put them into a vat, where they are suffered to lie for five or six days, or more; then they take them out in fair weather, and hang them out to dry on cords or racks: and the quicker they are dried the better; for if they be too long a drying, the salt and alum within them are apt to make them rise in a grain, which is an essential fault in this kind of dressing.

When the skins are dry, they are made up into bun-dles, and just dipt in fair water, and taken out and drain-ed; and being thrown into an empty tub, and after ha-ving lain some time are taken out and trampled under foot.

Then they draw them over a flat iron-instrument, the top of which is round like a battledore, and the bottom fixed into a wooden block, to stretch and open them; and having been opened, they are hung in the air upon cords to dry; and being dry, they are opened a second time, by passing them again over the same instrument.

In the last place they are laid on a table, pulled out, and laid smooth, and are then fit for sale.

**TAX**, a tribute rated upon every town, which formerly

was wont to be paid annually into the King's-exchequer, but now not without consent of parliament; it differs from a subsidy in this, that it is always certain, as set down in the exchequer-book, and in general levied of every town, and not particularly of every man, &c. The ancient way of levying taxes was by tenths and fifteenths, afterwards by subsidies and royal aids, and at length by a pound rate: the former of these were all upon the person and personal estate, but the last upon lands and rents.

**TAXUS**, in botany, a genus of the diœcia monodelphia class. The calix of both male and female consists of three leaves; neither of them have any corolla; the stamina are numerous; the antheræ are rotated, and divided into eight segments; the female has no stylius; and the berry contains one seed. There are two species, only one of them, *viz.* the baccata, or yew-tree, a native of Britain.

**TAY**, a river of Scotland, rising from the loch or lake of Tay, in Braidalbin, and running east through Athol: it afterwards turns south-east, and dividing the counties of Perth and Angus from Strathern and Fife, falls into the frith of Tay.

**TAYVEN**. a city of China, in Asia, in the province of Xanfi, two hundred and forty miles south-west of Pekin: E. long. 108°, N. lat. 38° 30'.

**TEA**, or **THEA**, in botany, a genus of the polyandria monogynia class of plants. The corolla consists of nine petals, and the calix of five leaves; and the berry is tri-coccos. There are two species, both natives of China.

This shrub grows to five or six feet high, and is very ramose: the leaves are about an inch long, near half an inch broad, serrated, and terminating in a point. The traders in tea distinguish a vast many kinds of it, as they differ in colour, flavour, and the size of the leaf. To enumerate the several subdivisions were endless; the general division is into three kinds, the ordinary green-tea, the finer green, and the bohea; to one or other of which all the other kinds may be referred. The common green tea has somewhat small and crumpled leaves, much convoluted, and closely folded together in the drying. Its colour is a dusky green, its taste sub-astringent, and its smell agreeable. It gives the water a strong yel lowish green colour. The fine green has larger leaves, less crumpled and convoluted in the drying, and more lax in their folds; it is of a paler colour, approaching to the blue-green, of an extremely pleasant smell, and has a more astringent, yet more agreeable taste than the former. It gives a pale-green colour to water. To this kind are to be referred all the higher priced green teas, the hyson, imperial, &c. The bohea consists of much smaller leaves than either of the other, and those more crumpled and closely folded than in either. It is of a darker colour than the other, often blackish; and is of the smell and taste of the others, but with a mixed sweetness and astringency. The green teas have all somewhat of the violet-flavour: the bohea has naturally somewhat of the rose-smell. The leaves when gathered are dried with great caution, partly by the help of heat, partly by the air, and when thoroughly prepared will keep a long time fresh and good. Every parcel, when dried, though gathered promiscuously, is separated, according to the largeness and smallness of the leaves, into three or four different kinds, each of which is of a different price, and has its different name. The bohea tea is ga-

thered before the leaves are perfectly opened, and is made to undergo a greater degree of heat in the curing, to which its colour and peculiar flavour is in a great measure owing.

Tea, moderately and properly taken, acts as a gentle astringent and corroborative.

**TEAL**, in ornithology. See **ANAS**.

**TEARS**, a lymph or aqueous humour, which is subtle, limpid, and a little saltish: it is separated from the arterial blood by the lachrymal glands, and small glandulous grains on the inside of the eye-lids. See **ANATOMY**, p. 294.

**TEBETH**, the tenth month of the Jewish ecclesiastical year, and fourth of the civil. It answers to our month of December.

**TECKLENBURG**, a city of Germany, in the circle of Westphalia, capital of a county of the same name, thirteen miles south-west of Osnabrug, subject to its own count: E. long. 7° 20', N. lat. 52° 21'.

**TECHNICAL**, expresses somewhat relating to arts or sciences: in this sense, we say technical terms.

**TE DEUM**, the name of a celebrated hymn, used in the Christian church, and so called because it begins with these words, *Te Deum laudamus*; "We praise thee, O God." It is sung in the Rom th church, with great pomp and solemnity, upon the gaining of a victory, or other happy event.

**TEES**, a river which rises on the confines of Cumberland; and running eastward divides the county of Durham from Yorkshire, and falls into the German sea below Stockton.

**TEFLIS**, the capital of Persian Georgia in Asia, situated on the river Kur, or Cyrus, three hundred miles north of Tauris, and as many south of Astracan: E. long. 47° 20', N. lat. 43°.

**TEGAPATAN**, a port-town of the hither India, in Asia, near Cape Comorin, eighty miles south of Cochin, and a hundred and sixty north-west of Columbo in Ceylon: E. long. 76°, N. lat. 8°.

**TEGUMENT**, any thing that surrounds or covers another.

**TEHAMA**, one of the divisions of Arabia Felix in Asia, situated on the Red-sea, between the provinces of Mecca and Hadramut.

**TEINTS** and **SEMI-TEINTS**, in painting, denotes the several colours used in a picture, considered as more or less high, bright, deep, thin, or weakened, and diminished, &c. to give the proper relief, softness, or distance, &c. of the several objects.

**TEISSE**, or **TEYS**, a river of Hungary, which rises in the Carpathian mountains; and running from east to west, passes from Tokay; then turning south, passes by Zolnock and Segedin; and having joined the river Merish, falls into the Danube, opposite to Salankamen.

**TELAMON**, a name given to those figures or half figures of men so commonly used, instead of columns or pilasters, to support any member in architecture, as a balcony, or the like.

**TELEPHIUM**, in botany, a genus of the pentandria trigynia class. The calix consists of five leaves; and the corolla of five petals, inserted into the receptacle; and the capsule has one cell and three valves. The species are two, none of them natives of Britain.

**TELE-**

TELESCOPE. See OPTICS, p. 421.

TELESIN, a province of the kingdom of Algiers, in Africa, situated on the confines of the empire of Morocco.

TELLER, an officer of the exchequer, in ancient records called tallier. There are four of these officers, whose duty is to receive all sums due to the king, and to give the clerk of the pells a bill to charge him therewith. They likewise pay all money due from the king, by warrant from the auditor of the receipt; and make weekly and yearly books, both of their receipts and payments, which they deliver to the lord treasurer.

TELLICHERRY, a port-town on the Malabar coast, in the Hither India, thirty miles north of Callicut: E. lon.  $75^{\circ}$  N. lat.  $12^{\circ}$ .

TEMESWAER, the capital city of the Bannat of Temeswaer, lately annexed to Hungary, sixty miles north-east of Belgrade: E. long.  $22^{\circ}$ , N. lat.  $45^{\circ} 55'$ .

TEMPERAMENT, among physicians, denotes the same with constitution; or a certain habitude of the humours of the human body, whereby it may be denominated hot, cold, moist, dry, bilious, sanguine; pælgmatic, melancholic, &c.

TEMPLARS, a religious order instituted at Jerusalem, about the year 1118. Some religious gentlemen put themselves under the government of the patriarch of Jerusalem, renounced property, made the vow of celibacy and obedience, and lived like canons regular. King Baldwin assigned them an apartment in his palace. They had likewise lands given them by the king, the patriarch, and the nobility, for their maintenance. At first there were but nine of this order, and the two principal persons were Hugo de Paganis, and Geoffrey of St Omers. About nine years after their institution, a rule was drawn up for them, and a white habit assigned them, by pope Honorius II. About twenty years afterwards, in the popedom of Eugenius III. they had red crosses sewed upon their cloaks, as a mark of distinction; and in a short time they were increased to about three hundred, in their convent at Jerusalem. They took the name of Knights Templars, because their first house stood near the temple dedicated to our Saviour at Jerusalem. This order, after having performed many great exploits against the infidels, became rich and powerful all over Europe; but the knights, abusing their wealth and credit, fell into great disorders and irregularities. Many crimes and enormities being alledged against them, they were prosecuted in France, Italy, and Spain; and at last, the pope, by his bull of the 22d of May 1312, given in the council of Vienna, pronounced the extinction of the order of Templars, and united their estates to the order of St John of Jerusalem.

TEMPLE, a general name for places of public worship, whether pagan, Christian or otherwise. But the word, in a restrained sense, is used to denote the places, or edifices, in which the pagans offered sacrifice to their false gods.

TEMPORAL, a term generally used for secular, as a distinction from ecclesiastical. Thus we say temporal lords, and spiritual or ecclesiastical lords.

TEMPORUM OSSA. See ANATOMY, p. 155

TENAILLE, in fortification. See FORTIFICATION, p. 619.

TENANT, one that holds lands or tenements of some lord, or landlord, by rent, fealty, &c. See TACK.

TENBURY, a market-town of Worcestershire, fifteen miles north-west of Worcester.

TENBY, a port-town of Pembrokehire, situated on Bristol channel: W. long.  $4^{\circ} 45'$ , N. lat.  $51^{\circ} 40'$ .

TENCH, in ichthyology. See CYPRINUS.

TENDER, a small ship, in the service of men of war, for carrying of men, provisions, or any thing else that is necessary.

TENDONS, are white, firm, and tenacious parts, continuous to the muscles, and usually forming their extremities. See ANATOMY, Part II.

TENEBRÆ, an office in the Romish church, performed on Wednesday, Thursday, and Friday, in Passion-week, at which time neither flowers nor images are allowed to be set upon the altars, but they must be covered with purple.

TENEBRIO, a genus of insects belonging to the order of coleoptera. The last joint of the antennæ is roundish; the breast is somewhat convex, and marginated; and the elytra are hard. There are 33 species, principally distinguished by their colour.

TENEDOS, one of the smallest islands of the Archipelago, situated near the coast of lesser Asia, west of the ruins of Tröy, E. long.  $27^{\circ}$ , N. lat.  $39^{\circ} 30'$ .

TENEMENT, properly signifies a house; but in a larger sense it is taken for any house, land, rent, or other thing, which a person holds of another.

TENERIF, one of the largest of the Canary Islands, situated in the Atlantic Ocean: W. long.  $17^{\circ}$ , N. lat.  $28$ . being about 130 miles in circumference. It is a fruitful island, abounding in corn, wine, and oil; though pretty much incumbered with mountains, of which the most remarkable is that called the Pico of Tenerif, being one of the highest mountains in the world, in the form of a sugar-loaf, the white top whereof may be seen at sea upwards of one hundred miles.

TENES, a province of the kingdom of Algiers, in Africa.

TENESMUS, in medicine, a name given, by medical writers, to a complaint which is a continual desire of going to stool, but without any stool being ready to be voided. This is usually attended with some tumour, sometimes with a very considerable one, in the part. This is properly no primary disease, but merely a symptomatic one, and differs in degree according to the disease on which it is an attendant.

TENOR, or TENOUR, the purport or content of a writing or instrument in law, &c.

Action of proving the TENOR, in Scots law. See LAW, Tit. xxx. 22.

TENOR, in musick, the first mean, or middle part, or that which is the ordinary pitch of the voice, when neither raised to a treble, nor lowered to a bass.

TENSE, in grammar, an inflection of verbs, whereby they are made to signify, or distinguish the circumstance of time, in what they affirm. See GRAMMAR.

TENT, in surgery, a roll of lint worked into the shape of a nail, with a broad flat head,

TENTER, a machine used in the cloth-manufacture, to stretch out the pieces of cloth, stuff, &c. or only to make them even, and set them square.

It is usually about four feet and a half high, and for length exceeds that of the longest piece of cloth. It consists of several pieces of wood, placed like those which

- form the barriers of a manege; so that the lower cross piece of wood may be raised or lowered, as is found requisite, to be fixed at any height, by means of pins. Along the cross-pieces, both the upper and under one are hooked nails, called tenter-hooks, driven in from space to space.
- TENTHREDO**, a genus of insects belonging to the order of hymenoptera. The mouth is furnished with jaws, but has no proboscis; the wings are plain and tumid; the sting consists of two serrated laminae, and the scutellum of two grains placed at a distance. There are 55 species, principally distinguished by their colour, and the figure of the antennae.
- TENURE**, in law, signifies the manner whereby lands or tenements are held, or the service that the tenant owes to his lord. It likewise denotes the estate in the land. In England, tenures were anciently divided into the following esuages; that is, land held by the service of the shield, and thereby the tenant was, at his own expence, obliged to follow his lord into the wars. Knight's service and chivalry; when lands were held of the king, or mesne-lord, to perform service in war. Burgage tenure; land held of the lord of the burrow, at a certain rent. Villenage, otherwise termed base-tenure; whereby the tenant was bound to do all inferior services, commanded by the lord. Grand serjeanty; lands held by honorary services at the king's coronation. Petit serjeanty; lands held of the king, to contribute yearly some small thing towards his wars. Frankalmoine; that tenure by which lands were held by ecclesiastics, in free and perpetual alms. Socage tenure; where lands are held by tenants, to plow their lord's lands, and perform every office of husbandry, at their own expence. But all these ancient tenures and services are in general taken away, and reduced into common and free socage. The usual tenures at present are, fee simple; which is an absolute tenure of lands to a man and his heirs for ever. Fee-tail; a limited fee, to a person and the heirs of his body begotten. Curtesy tenure; where a man having married a woman seised in fee, &c. has issue born alive by her, in which case, after her death, the husband is tenant by the curtesy of England. Tenure in dower; is where a widow holds, for her life, a third part of her husband's land, whereof he was seised in fee at any time during the coverture. There is also a tenure for life, or years, when lands are held for those terms on reserved rents. Copyhold tenure, is a holding for lives, or in fee, at the will of the lord, according to the custom of the manor. For the several kinds of tenure or holding in Scotland, see **LAW**, Tit. xi.
- TEPID**, a term used by writers on mineral waters, &c. to express such of them as have a less sensible cold than common water.
- TERCE**, in Scots law. See **LAW**, Tit. xvi. 24.
- TERCERA**, one of the largest of the Azores or western islands, situated in the Atlantic ocean: W. long. 28°, and N. lat. 39°.
- TEREBINTHUS**, in botany. See **PISTACIA**.
- TERES**, in anatomy. See **ANATOMY**, p. 195.
- TERGOWISCO**, the capital of Wallachia, in European Turkey, eighty miles south-east of Hermanstat in Transylvania: E. long. 26° 30', N. lat. 45° 35'.
- TERM**, in general, signifies much the same with boundary or limit.
- TERM**, in law, is generally taken for a limitation of time or estate: as a lease for term of life, or years.
- TERM**, in grammar, denotes some word or expression of a language.
- TERM** in the arts, or **TERM** of art, is a word which, besides the literal and popular meaning which it has, or may have, in common language, bears a further and peculiar meaning in some art or science.
- TERMINALIA**, in antiquity, feasts celebrated by the Romans, in honour of the god Terminus.
- TERMINATION**, in grammar, the ending of a word, or last syllable thereof.
- TERNATE**, the most northerly of the Molucca or Clove-islands, in the possession of the Dutch.
- TERRA**. See **GEOGRAPHY**, and **ASTRONOMY**.
- TERRA FIRMA**, in geography, is sometimes used for a continent, in contradistinction to islands.
- TERRA DEL FOGO**, an island of South-America, from which it is separated by the streights of Magellan.
- TERRÆ FILIUS**, SON OF THE EARTH, a student of the university of Oxford; formerly appointed, in public acts, to make jesting and satirical speeches against the members thereof, to tax them with any growing corruptions, &c.
- TERRACE**, a walk or bank of earth, raised in a garden or court, to a due elevation, for a prospect.
- TERRAQUEOUS**, in geography, an appellation given to our globe, because consisting of land and water.
- TERRELLA**, an appellation given to a loadstone, when turned into a spherical figure, and is placed so, that its poles and equator, &c. correspond to the poles and equator of the world; as being a just representation of the great magnetical globe which we inhabit.
- TERRESTRIAL**, something partaking of the nature of earth, or belonging to the globe of the earth: thus we say, the terrestrial globe, &c.
- TERRIER**, a book, or roll, wherein the several lands, either of a private person, or of a town, college, church, &c. are described. It should contain the number of acres, and the site, boundaries, tenants names, &c. of each piece or parcel.
- TERRIER** is also used for a small hound. See **CANIS**.
- TERRITORY**, in geography, denotes an extent or compass of land, within the bounds, or belonging to the jurisdiction, of any state, city, or other subdivision of a country.
- TERROUEN**, a town of Artois, in the French Netherlands, situated on the river Lis, six miles south of St Omers.
- TERTIAN**, in medicine. See **MEDICINE**, p. 61.
- TERTIATE** a great gun, in gunnery, is to examine the thickness of the metal at the muzzle, whereby to judge of the strength of the piece, and whether it be sufficiently fortified. This is usually done with a pair of caliber-compasses; and if the piece be home bored, the diameter less by the height, divided by 2, is the thickness at any place.
- TERVEL**, a city of Arragon, in Spain, situated on the river Guadalavira, seventy-five miles south of Sarragossa: W. long. 1° 20', N. lat. 40° 35'.
- TESSELATED PAVEMENTS**, those of rich Mosaic work, made

made of curious square marbles, bricks; or tiles, called tessellæ, from their resembling dice.

**TESSIN**, a river of Italy, which, taking its rise in the Alps, runs through the country of the Grisons and the lake Maggior; and then, turning south-east through the Milanese, passes by Pavia, and falls into the Po, a little below that city.

**TEST**, a vessel of the nature of the coppel, used for large quantities of metals at once.

**TEST-LIQUOR**, a liquor used by dealers in brandies, to prove whether they be genuine, or mixed with home-spirits. This liquor is nothing but a green or white vitriol, dissolved in fair water; for a few drops of it being let fall into a glass of old French brandy, will turn the whole to a purple, or fine violet colour; and by the strength or paleness of this colour, the dealers judge the brandy to be genuine or mixed, in different proportions, with home-spirits.

**TEST-ACT**, a statute 25 Car. II. cap. 2. which requires all officers, both civil and military, to take the oaths and test, *viz.* the sacrament, according to the rites and ceremonies of the church of England; for the neglect whereof, a person executing any office mentioned in that statute, forfeits the sum of 500 l. recoverable by action of debt.

**TESTACEOUS**, in natural history, an epithet given to animals covered with a shell, as tortoises, oysters, pearl-fish, &c.

**TESTAMENT**. See **LAW**, Tit. xxviii. 2.

**TESTATOR**, the person who makes his will and testament.

**TESTES**, in anatomy. See **ANATOMY**, p. 270.

**TESTIMONY**. See **EVIDENCE**.

**TESTUDO**, in zoology, a genus belonging to the order of amphibia reptilia. It has four legs and a tail, and the body is covered with a strong shell. There are 15 species, principally distinguished by peculiarities in their feet. The midas, or common turtle, is found at the Ascension isle, and many other southern islands. The shell of this animal is so strong, that several men may stand upon it without injury. It lays membranaceous eggs in round holes which it digs in the sand. The turtle is said to continue several weeks in the acts of copulation. It grows to a vast size, some having been found to weigh 480 pounds.

The Americans find so good account in catching turtle, that they have made themselves very expert at it: they watch them from their nests on shore, in moon-light nights; and, before they reach the sea, turn them on their backs, and leave them till morning; when they are sure to find them, since they are utterly unable to recover their former posture: at other times they hunt them in boat, with a peculiar kind of spear, striking them with it through the shell; and as there is a cord fastened to the spear, they are taken much in the same manner as the whales.

**TESTUDO**, in antiquity, was particularly used among the poets, &c. for the ancient lyre; by reason it was originally made by its inventor Mercury, of the black or hollow shell of the testudo aquatica, or sea-tortoise, which he accidentally found on the banks of the river Nile.

**TESTUDO**, in the military art of the ancients, was a kind of cover or screen which the soldiers, *e. gr.* a whole company, made themselves of their bucklers, by holding them up over their heads, and standing close to each other.

This expedient served to shelter them from darts, stones, &c. thrown upon them, especially those thrown from above, when they went to the assault.

**TESTUDO** was also a kind of large wooden tower, which moved on several wheels, and was covered with bullocks' hides spread, serving to shelter the soldiers when they approached the walls to mine them, or to batter them with rams.

It was called testudo, from the strength of its roof, which covered the workmen as the shell does the tortoise.

**TETANUS**, in medicine, a convulsive motion that makes any part rigid or inflexible.

**TETHYS**, a genus of insects belonging to the order of vermes mollusca. The body is oblong, fleshy, and without feet; the mouth consists of a cylindrical proboscis under the duplicature of a lip; and there are two foramina at the left side of the neck. The species are two, both inhabitants of the ocean.

**TETICACO**, a great lake of Peru, more than two hundred miles in circumference: the towas situated on this lake are esteemed the most delightful in all South America.

**TETRACERA**, in botany, a genus of the polyandria tetragynia class. The calix consists of six leaves; and there are four capsules. There is but one species, a native of America.

**TETRACHORD**, in the ancient musick, a concord consisting of four degrees or intervals, and four terms or sounds; called also by the ancients diatessaron, and by us a fourth.

**TETRADECARHOMBIS**, in natural history, the name of a genus of fossils, of the class of the selenitæ, expressing a rhomboidal body, consisting of fourteen planes.

The characters of this genus are, that the bodies of it are exactly of the same form with the common selenitæ; but that each of the end-planes is divided into two; and there are, by this means, eight of these planes, instead of four.

**TETRADIAPASON**, a musical chord, otherwise called a quadruple diapason, or eighth.

**TETRADYNAMIA**, in botany. See **BOTANY**, p. 635.

**TETRAEDRON**, in geometry, one of the five regular or platonic bodies or solids, comprehended under four equilateral and equal triangles.

**TETRAGON**, in geometry, a general name for any four-sided figure, as a square, parallelogram, rhombus, or trapezium.

**TETRAGONIA**, in botany, a genus of the icosandria pentagynia class. The calix consists of four segments; it has no corolla; and the drupa has four sides, and four cells. There are two species, both natives of Æthiopia.

**TETRAGONOTHECA**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is paleaceous; it has no pappus; and the calix consists of one leaf, divided into four plain segments. There is but one species, a native of Virginia.

**TETRAGRAMMATON**, a denomination given by the Greeks to the Hebrew name of God, Jehovah, because consisting of four letters.

**TETRANDRIA**, in botany. See **BOTANY**, p. 635.

**TETRAO**, in ornithology, a genus of birds, of the order of gallinæ, distinguished by having the part of the forehead near the eyes naked and papillose. There are 20 species, distinguished principally by their colour, their having rough or naked feet, &c.

- TETRAPETALOUS**, in botany, an epithet given to flowers that consist of four single petals or leaves.
- TETRAPHARMACUM**, signifies any remedy consisting of four ingredients.
- TETRAPTERA**, a name given to insects which have four wings.
- TETRAPTOTE**, in grammar, a name given to such defective nouns as have only four cases; such are *vicis, pecudis, fordis*, &c. as being deprived of the nominative and vocative singular.
- TETRAPHYRAMIDIA**, in natural history, the name of a genus of spars, influenced in their shape by an admixture of particles of tin, and found in form of broad-bottomed pyramids of four sides.
- TETRARCH**, a prince who holds and governs a fourth part of a kingdom. Such originally was the import of the title tetrarch; but it was afterwards applied to any petty king or sovereign.
- TETRASTYLE**, in the ancient architecture, a building, and particularly a temple, with four columns in its front.
- TETUAN**, a town of the empire of Morocco, situated about eight miles from the bay of that name, just within the straits of Gibraltar: W. long. 6° 35', N. lat. 35° 40'.
- TEUCRIUM**, in botany, a genus of the didynamia gymnospermia class. The upper lip of the corolla is bipartite. There are 31 species, four of them natives of Britain, *viz.* the scordium, or water germander, the leaves of which are said to be deobstruent, diuretic, and sudorific; the chamedrys, or germander, the leaves, tops, and seeds of which are said to be sudorific, diuretic, &c.; the chamæpitys, or ground pine, the leaves of which are recommended as aperient and vulnerary; and the scorodonia, or wood-fage.
- TEUTONIC**, something belonging to the Teutons, an ancient people of Germany, inhabiting chiefly along the coasts of the German ocean: thus, the Teutonic language is the ancient language of Germany, which is ranked among the mother tongues. The Teutonic is now called the German or Dutch.
- TEUTONIC ORDER**, a military order of knights, established towards the close of the twelfth century, and thus called as consisting chiefly of Germans or Teutons. The origin, &c. of the Teutonic order, is said to be this. The Christians, under Guy of Lusignan, laying siege to Acre, or Acon, a city of Syria, on the borders of the Holy Land, some Germans of Bremen and Lubec, touched with compassion for the sick and wounded of the army, who wanted common necessities, set on foot a kind of hospital under a tent, which they made of a ship's sail, and here betook themselves to a charitable attendance on them. This started a thought of establishing a third military order, in imitation of the templars and hospitalers. The design was approved of by the patriarch of Jerusalem, the archbishops and bishops of the neighbouring places, the king of Jerusalem, the masters of the temple and hospital, and the German lords and prelates then in the Holy Land. and pope Calixtus III. confirmed it by his bull, and the new order was called the order of the Teutonic knights of the house of St. Mary at Jerusalem. The pope granted them all the privileges of the Templars and Hospitalers of St. John, excepting that they were to be subject to the patriarchs and other prelates, and that they should pay tithes of what they possessed.
- TEWKSBURY**, a borough-town of Gloucestershire, situated on the river Severn, ten miles north of Gloucester. It sends two members to parliament.
- TEXEL**, an island of Holland, situated at the entrance of the Zuyder-sea, parted from the continent of Holland by a narrow channel, through which most ships bound to Amsterdam pass.
- TEXT**, a relative term, contradistinguished to gloss or commentary, and signifying an original discourse exclusive of any note or interpretation.
- TEXTURE**, properly denotes the arrangement and cohesion of several slender bodies or threads interwoven or entangled among each other, as in the webs of spiders, or in cloths, stuffs, &c.
- THALAMI** *nervorum opticorum*. See ANATOMY, p. 286.
- THALIA**, in botany, a genus of the monandria monogynia class. The corolla consists of five waved petals; and the drupa has a double-celled nucleus. There is but one species, a native of America.
- THALICTRUM**, in botany, a genus of the polyandria polygynia class. The corolla consists of five petals; it has no corolla; and the seeds are naked. There are 14 species, three of them natives of Britain, *viz.* the flavum, or meadow-rue; the minus, or lesser meadow-rue; and the alpinum, or mountain meadow-rue.
- THAMES**, a great navigable river of England, composed chiefly of the river Isis and Thame; of which the Isis is much the largest, and runs the longest course, rising on the confines of Gloucestershire. At Lechlade it becomes navigable, from whence it continues its course north-east to Oxford, where it receives the Charwell; from Oxford it runs south-east to Abington, and so to Dorchester, where it receives the Thame, and continues its course south-east to Windsor, and thence runs east to London, and continues the same course to the sea, receiving the river Medway near the mouth of it. The Thame is but a small river, which rising near Tring in Hertfordshire, crosses the county of Bucks, and falls into the Isis at Dorchester.
- THANE**, or **THAIN**, a name of an ancient dignity among the English and Scots, or Anglo-Saxons. Skene makes thane to be a dignity equal to the son of an earl. Camden will have it, that thanes were only dignified by the offices they bore. There were two kinds or orders of thanes; the king's thanes, and the ordinary thanes. The first were those who attended the king in his courts, and who held lands immediately of the king. The ordinary thanes, or the *thani minores*, were the lords of the manors, who had particular jurisdiction within their limits, and over their own tenants; these changed their names for that of barons, and hence their courts are called courts-baron to this day.
- THANET**, a little island of east Kent, formed by the branches of the Stour and the sea.
- THAPSIA**, in botany, a genus of the pentandria digynia class. The fruit is oblong, and surrounded with a membrane. There are four species, none of them natives of Britain.
- THAWING**, the resolution of ice into its former fluid state, by the warmth of the air, &c. See FREEZING.
- THEA** in botany See TEA.
- THEATINES**, a religious order in the Romish church, so called

called from their principal founder John Peter Caraffa, then bishop of Theate, or Chiete, in the kingdom of Naples, and afterwards pope, under the name of Paul IV. The names of the other founders were Gaetan, Boniface, and Configlieri. These four pious men, desiring to reform the ecclesiastical state, laid the foundation of an order of regular clerks at Rome, in the year 1524. Pope Clement VII. approved the institute, and permitted the brethren to make the three religious vows, to elect a superior every three years, and to draw up statutes for the regulation of the order. They first endeavoured, by their example, to revive among the clergy the poverty of the apostles and first disciples of our Saviour, and were the first who assumed the title of regular clerks.

**THEATRE**, a public edifice for the exhibiting of scenic spectacles, or shews, to the people; comprehending not only the eminence on which the actors appear, and the action passes, but also the whole area of the place common to the actors and spectators.

**THEBAID**, a celebrated heroic poem of Statius, the subject whereof is the civil war of Thebes, between the two brothers Eteocles and Polyneices; or, Thebes taken by Theseus.

**THEBES**, the name of an ancient city in upper Egypt, now in ruins; as also an ancient city of Achaia, now a province of European Turkey.

**THEFT**. See **LAW**, Tit. xxxiii. 28.

**THEISM**. See **DEISM**.

**THELEGONUM**, in botany, a genus of the monœcia polyandria class. The calix both of male and female consists of two segments; neither of them have any corolla; the stamina are 12; and the female has one stylus, and a coriaceous capsule, with one cell and one seed. There is but one species, a native of Italy.

**THEME**, denotes the subject of an exercise, for young students to write or compose on.

**THENAR**, in anatomy. See **ANATOMY**, p. 200.

**THEOBROMA**, the **CHOCOLATE-NUT-TREE**, in botany, a genus of the polyadelphia pentandria class. The corolla consists of five petals; the nectarium is bell-shaped; and the fruit is a woody cortex, of an unequal surface, with five ridges. There are two species, both natives of America.

**THEOCRACY**, in matters of government, a state governed by the immediate direction of God alone: such was the ancient government of the Jews, before the time of Saul.

**THEODOLITE**, a mathematical instrument much used in surveying. See **GEOMETRY**, p. 701.

**THEOGONY**, that branch of the heathen theology, which taught the genealogy of their gods.

**THEOLOGY**. See **RELIGION**.

**THEOPHRASTA**, in botany, a genus of the pentandria monogynia class. The corolla is bell-shaped, with obtuse segments; and the capsule has one round large cell, and one seed. There is but one species, a native of America.

**THEOREM**, a speculative proposition, demonstrating the properties of any subject.

**THEORETIC**, something relating to theory, or that terminates in speculation. See **THEORY**.

**THEORY**, in general, denotes any doctrine which termi-

nates in speculation alone, without considering the practical uses and application thereof.

**THERAPEUTÆ**, a term applied to those who are wholly employed in the service of religion. This general term has been applied to particular sects of men, concerning whom there have been great disputes among the learned.

**THERAPEUTICS**, that part of medicine which acquaints us with the rules that are to be observed, and the medicines to be employed in the cure of diseases.

**THERAPHIM**, certain images, or superstitious figures, mentioned in scripture. Some Jewish writers tell us, the theraphim were effigies of human heads, placed in niches, and consulted as oracles. Others say, they were talismans, or figures of metal, cast and engraved under certain aspects of the planets; to which they ascribed extraordinary effects.

**THERIACA ANDROMACHI**, a compound medicine, made in the form of an electuary.

**THERMÆ**, artificial hot baths, much used by the Romans.

**THERMOMETER**, an instrument for measuring the increase and decrease of the heat and cold of the air, by means of the elastic and expansive power of bodies of the fluid sort. See **PNEUMATICS**, p. 486.

**THESEA**, in antiquity, feasts celebrated by the Athenians, in honour of Theseus, consisting of sports and games, with mirth and banquets: such as were poor, and unable to contribute to them, were entertained at the public expence.

**THESIS**, a general position which a person advances, and offers to maintain. In colleges it is frequent to have placards, containing a number of them, in theology, in medicine, in philosophy, in law, &c.

**THESIUM**, in botany, a genus of the pentandria monogynia class. The calix consists of one leaf, into which the stamina are inserted; there is but one seed. The species are seven, only one of them, *viz.* the linophyllon, or bastard toad-flax, a native of Britain.

**THESSALY**, now called Janna, a province of European Turkey, bounded by Macedonia, on the north; by the Archipelago, on the east; by Achaia, or Livadia, on the south; and by Epirus, on the west.

**THETFORD**, the county-town of Norfolk, situated twenty-five miles south-west of Norwich. It sends two members to parliament.

**THEURGY**, a name given to that part of magic called white magic, or the white art. Those who have written of magic have divided it into three kinds: the first is theurgy, as operating by divine means: the second, natural magic, performed by the powers of nature: and the third, necromancy, which they imagined proceeded from invoking demons.

**THIBET**, one of the most powerful of the Tartar kingdoms, having China on the east, and India on the west.

**THIGH**, in anatomy. See **ANATOMY**, p. 182, 203.

**THIMBLE**, an instrument made of brass, silver, iron, &c. put on the finger to thrust a needle through any cloth, silk, &c. used by all seamstresses, taylors, &c.

**THINKING**, a general name for any act or operation of the mind. See **LOGICK**, and **METAPHYSICS**.

**THIRLAGE**. See **LAW**, Tit. xvi. 12.

**THIRSK**, a borough-town in the north-riding of Yorkshire,

shire, situated on the river Swale, sixteen miles north-west of York. It sends two members to parliament.

**THIRST**, an uneasy sensation, arising from a deficiency in the saliva to moisten the inward parts of the mouth; hence arises a strong desire for drink: it is a symptom generally attending feverish disorders.

**THISTLE**, in botany. See **CARDUUS**.

*Order of the THISTLE, or of St ANDREW*, a military order of knighthood in Scotland, the rise and institution whereof is variously related by different authors. Lesley, bishop of Ross, reports, that the night before the battle between Athelstan king of Northumberland, and Hungus king of the Picts, a bright cross, in form of that whereon St Andrew (the tutelar saint of Scotland) suffered martyrdom, appeared to Hungus; who having gained the victory, ever after bore the figure of that cross on his banners. Others assert, that Achaius king of Scotland first instituted this order, after having made the famous league offensive and defensive with Charlemagne king of France. But although the thistle had been acknowledged as the symbol of the kingdom of Scotland from the reign of Achaius, yet some refer the beginning of this order to Charles VII. of France. Others place the foundation of it as low as the year 1500.

The chief and principal ensign is a gold collar composed of thistles and sprigs of rue interlinked with amulets of gold, having pendent thereunto the image of St Andrew with his cross, and the motto, *NEMO ME IMPUNE LA-CESSET*.

The ordinary or common ensign worn by the knights, is a star of four silver points, and over them a green circle, bordered and lettered with gold, containing the said motto, and in the centre is a thistle proper; all which is embroidered on their left breast, and worn with the collar, with a green ribband over the left shoulder, and brought under the right arm; pendent thereto is the image of St Andrew, with his cross, in a purple robe, within an oval of gold enamelled vert, with the former motto: but sometimes they wear, encircled in the same manner, a thistle crowned.

About the time of the reformation, this order was dropped, till James II. of England resumed it, by creating eight knights: however, the revolution unsettled it again, and it lay neglected till queen Anne, in 1703, restored it to the primitive design, of twelve knights of St Andrew.

**THLASPI**, in botany, a genus of the tetradymania siliculosa class. The pod is emarginated, heart-shaped, containing many seeds. There are ten species, six of them natives of Britain, *viz.* the campestre, or mithridate; the arvense, or treacle-mustard; the perfoliatum, or perfoliate treacle-mustard; the furtum, or perennial mithridate mustard; the montanum, or mountain mithridate-mustard; and the burfa pastoris, or shepherd's purse.

**THOMÆANS**, **THOMISTS**, or *Christians of St THOMAS*, a people of the East-Indies, who, according to the tradition, received the Gospel from St Thomas. Upon the arrival of the Portuguese at Calicut, in their first voyage to the Indies, they met with ancient Christians, who pretended to be descended from those converted by St Thomas. The Thomæans being informed of a new people arrived among them, who bore a particular veneration for the

cross, sent ambassadors to them, to make an alliance with them, and to solicit their assistance against the Gentile princes, by whom they were greatly oppressed. A mixture of opinions, with a total interruption of pastors, sometimes for several years together, occasioned that horrible chaos their religion was in at the arrival of the Portuguese; for a specimen whereof we shall add their manner of celebrating the eucharist: Over their altar was a kind of gallery; and while the priest was saying the beginning of the office below, a cake of flour of rice was frying in oil, or butter, above; when enough, the cake was let down in a basket upon the altar, where the priest consecrated it: as to the other species, for wine they used a kind of brandy or arrack, variously prepared in that country. Nor was their ordination much more regular; the archdeacon, who was sometimes more respected than the bishop himself, frequently ordained priests: their other abuses were infinite. The Portuguese, for these two last centuries, have laboured the reformation of this church, and have employed both the ecclesiastic and secular power therein: for this end they have called the Thomæan bishops to the council at Goa, have instructed, charged them, &c. and even sent them for instruction to Portugal and Rome; but finding that they were still apt to relapse after their return, and that no good was like to be done with them, they resolved to exclude them once for all, and to appoint an European bishop in their room. These proceedings have rendered the Portuguese infinitely odious to the Thomæans.

**St THOMAS**, a city of the hither India, on the coast of Coromandel, three miles south of Fort St George; subject to the Portuguese.

**St THOMAS** is also an island in the Atlantic ocean, situated under the equator, in 8° E. long.

**St THOMAS** is also a town of Guiana, in South America; situated on the river Oronoko; subject to Spain.

**St. THOMAS'S DAY**, a festival of the Christian church, observed on Dec. 21. in commemoration of St Thomas the apostle.

**St THOMAS of Canterbury's day**, a festival of the Romish church, observed on Dec. 29. in memory of Thomas Becket archbishop of Canterbury, who was murdered, or, as the Romanists say, martyred, in the reign of king Henry II.

**THOMISM**, the doctrine of St Thomas Aquinas, and his followers the Thomists, chiefly with regard to predestination and grace. There is some doubt what the true genuine thomism is, but there are authors who distinguish the thomism of St Thomas from that of the dominicans. Others again make thomism no other than a kind of jansenism disguised: but jansenism, it is known, has been condemned by the popes, which pure thomism never was: in effect, the writings of Alvarez and Lemos, who were appointed by their order to lay down and defend, before the holy see, the dogmata of their school, have since been reputed the rule of pure thomism.

**THOMISTS**, a sect of school-divines, who maintain thomism. See the preceding article.

**THORACIC DUCT**. See **ANATOMY**, p. 282.

**THORAX**, in anatomy. See **ANATOMY**, p. 277.

**THORN**, a city of Poland, in the province of regal Prussia, situated on the river Vistula: E. long. 19°, and N. lat. 52° 40'.

**THORN**-

THORNBACK, in ichthyology. See RAIA.

THORNBURY, a market-town of Gloucestershire, situated twenty miles south-west of Gloucester.

THORNEY-ISLAND, an island made by the branches of the Thames formerly, where Westminster-abbey now stands.

THORNEY-ISLAND is also an island situated in a bay of the East channel, between Chichester and Portsmouth.

THOUGHT, a general name for all the ideas consequent on the operations of the mind, and even for the operations themselves.

THOULON, or TOULON, a port-town of Provence, in France, situated on a bay of the Mediterranean sea : E. long. 6°, and N. lat. 43° 5'.

THOULOSE, or TOULOSE, a city of France, capital of the city of Languedoc, situated on the river Garonne : E. long. 1° 5', and N. lat. 43° 40'.

THRACE, a province of European Turkey, situated on the north side of the Propontis.

THRASHING, or THRESHING, in agriculture, the art of beating the corn out of the ears.

There are two ways of separating corn from the ear ; the first by beating it with a flail, which is properly what is called thrashing. The other method, still practised in several countries, is to make mules, or horses, trample on it, backwards and forwards ; this is properly what the ancients called tritura and trituratio. The Hebrews used oxen therein, and sometimes yoked four together for this purpose. Another way among the ancients was with a kind of sledge, made of boards joined together, and loaden with stones or iron, upon which a man was mounted, and the whole drawn over the corn by horses : this instrument was called traha, or tribula.

THRAVE of corn, twenty-four sheaves, or four shocks of six sheaves to the shock; though, in some countries, they only reckon twelve shocks to the thrave.

THRICHECHUS, in zoology, a genus of quadrupeds belonging to the order of bruta. There are no fore-teeth in either jaw; the dog-teeth in the upper jaw are solitary; the lips are doubled; and in place of the two hind legs, they have a broad fleshy tail or fin. There are two species, *viz.* 1. The rosmarinus, morse, sea-horse, or wall-rose, has the dog-teeth of the upper-jaw protruded out of the mouth. This animal is found in the ocean, within the polar circle. It grunts like a hog, and is about the size of a bull. 2. The monatus, or sea-cow, has the dog teeth not protruded. It is found in the American and Indian ocean, principally at the mouths of rivers. It feeds upon sea-weeds, and is about twelve feet long. The females have, between the pectoral fins, two large, round, and fair breasts; and both sexes have the parts of generation, and the navel, perfectly resembling those of the human species: there is no doubt but all the fables concerning mermaids, mermen, and syrens, took their rise from an imperfect view of this animal.

THRIPS, a genus of insects belonging to the order of hemiptera. The beak is obscure; the feelers are of an equal length with the breast; the body is linear; and it has four strait wings lying cross-ways upon the back. There are five species, distinguished by their colour.

THROAT, the anterior part of an animal, between the head and the shoulders, wherein is the gullet.

THRONE, a royal seat, or chair of state, enriched with

ornaments of architecture and sculpture, raised on one or more steps, and covered with a kind of canopy. Such are the thrones in the rooms of audience of kings and other sovereigns.

THROWSTER, one who prepares raw silk for the weaver, by cleansing and twisting it.

THRUSH, in ornithology. See TURDUS.

THULE, of the ancients, supposed to be the islands of Orcaades.

THUMB, in anatomy, one of the parts or extremities of the hand. See ANATOMY, p. 181.

THUMMIM. See URIM.

THUNDER, a noise in the regions of the air, excited by sudden flashes of lightning. See ELECTRICITY, p. 480, 484.

THURINGIA LANDGRAVIATE, one of the divisions of the circle of Upper Saxony, in Germany, having the duchy of Magdeburg on the north, and Franconia on the south.

THURSDAY, the fifth day of the Christian week, but the sixth day of that of the Jews.

THURSO, a port-town of Caithness, in Scotland, situated on the Caledonian ocean, fifteen miles south-west of Dungsby-head.

THUYA, in botany, a genus of the monœcia monadelphia class. The calix of the male is an amentum, that of the female a strobilus; neither of them have any corolla; there is one pistillum, and one nut surrounded with an emarginated wing. The species are three, all natives of warm countries.

THYMUS, in botany, a genus of the didynamia gymnospermia class. The calix is bilabiated, and the faux is shut up with hairs. There are eight species, two of them natives of Britain, *viz.* the serpillum, or common thyme; and the acinos, or wild basil.

THYMUS, in anatomy. See ANATOMY, p. 278.

THYROARYTÆNOIDES, in anatomy. See ANATOMY, p. 301.

THYROIDE CARTILAGE. See ANATOMY, p. 300.

THYRSUS, in antiquity, the sceptre which the poets put into the hand of Bacchus. And wherewith they furnished the menades in their bacchanalia.

TIARA, an ornament or habit wherewith the ancient Persians covered their head; and which the Armenians, and kings of Pontus, still wear on medals; these last, because descended from the Persians.

TIARA is also the name of the pope's triple crown.

TIBER, a great river of Italy, which runs through the pope's territories, passing by Perugia and Orvietto; and having visited Rome, falls into the Tuscan sea at Ostia, fifteen miles below that city.

TIBIA, in anatomy. See ANATOMY, p. 183.

TIBIALIS, in anatomy. See ANATOMY, p. 209.

TIDES. See ASTRONOMY, p. 473.

TIDE-WAITERS, or TIDESMEN, are inferior officers belonging to the custom-house, whose employment it is to watch or attend upon ships, until the customs be paid: they get this name from their going on-board ships, on their arrival in the mouth of the Thames or other port, and so come up with the tide.

TIEND, in Scots law. See LAW, Tit. xvii. 1, &c.

TIERCE, or TEIRCE, a measure of liquid things, as wine, oil, &c. containing the third part of a pipe, or forty-two gallons.

**TIERCED**, in heraldry, denotes the shield to be divided by any part of the partition-lines, as party, coupy, tranchy, or tally, into three equal parts of different colours or metals.

**TIGER**, in zoology. See **FELIS**.

**TIGRIS**, a large river of Turkey in Asia, which, rising in the mountains of Armenia, runs southward, dividing Diarbeck or Mesopotamia, from Curdistan or the ancient Assyria; and having passed by Badgat, joins the Euphrates in Eyraca Arabic, or the ancient Chaldea.

**TILBURY**, a fortress in the county of Essex, situated on the river Thames, opposite to Gravesend, twenty miles east of London.

**TILIA**, in botany, a genus of the polyandria monogynia class. The corolla consists of five petals, and the calix of five segments; the berry is dry, and round, with five cells, and five valves. There are two species, only one of them, *viz.* the *Europæa*, or lime-tree, a native of Britain.

**TILLÆA**, in botany, a genus of the tetrandria tetragynia class. The calix consists of three segments, and the corolla of three equal petals; and there are three capsules containing three seeds. The species are two, none of them natives of Britain.

**TILLANDSIA**, in botany, a genus of the hexandria monogynia class. The calix consists of three persistent segments; the corolla is bell-shaped, with three segments; the capsule has one cell, containing a single pappous seed. There are nine species, none of them natives of Britain.

**TILLER** of a ship, a strong piece of wood fastened in the head of the rudder, and in small ships and boats called the helm.

**TILLAGE**. See **AGRICULTURE**, p. 54.

**TIMAR**, a tract or portion of land, which the grand seignior grants to a person on condition of serving him in a war on horse-back. Hence, those who enjoy such lands are called timariots.

**TIMBER**, includes all kinds of felled and seasoned woods.

**TIME**, a succession of phenomena in the universe; or a mode of duration marked by certain periods or measures, chiefly by the motion and revolution of the sun. See **ASTRONOMY**, p. 489.

**TIME**, in music, is an affection of sound, whereby we denominate it long or short, with regard to its continuance in the same degree of time. See **MUSIC**.

**TIMOR**, an island in the Indian ocean, situated between 122° and 126° of east long, and between 8° and 10° south lat.

It is in possession of the Dutch, and said to have gold mines.

**TIN**. See **CHEMISTRY**, p. 83, 105, 135.

**TINCTURE**, in pharmacy and chemistry, a separation of the finer and more volatile parts of a mixed body, made by means of a proper menstruum dissolving and retaining the same.

**TINCTURE**, in heraldry, the hue or colour of any thing in coat armour, under which denomination may be also included the two metals, or and argent, because they are often represented by yellow and white.

**TINE**. There are two rivers of this name; the one called North-Tine, which rises on the borders of Scotland; and the other South-Tine, which rises on the confines of Cumberland; the one running south-east, and the other

north-east: they unite their waters at Hexham, and continuing to run east, divide the counties of Durham and Northumberland, passing by Newcastle, and falling into the German sea at Tinmouth.

**TINMOUTH**, a port-town of Northumberland, situated on the German sea, at the mouth of the river Tine, seven miles east of Newcastle.

**TINNING**, the covering or lining any thing with melted tin, or with tin reduced to a very fine leaf. Looking-glasses are foliated, or tinned, with thin plates of beaten tin, the whole bigness of the glass, applied or fastened thereto by means of quicksilver. See **FOLIATING**.

**TINNITUS AURIUM**. See **MEDICINE**, p. 156.

**TINUS**, in botany, a genus of the eneandria monogynia class. The calix consists of five segments, and the corolla of five petals; the berry has three cells, containing one seed. There is but one species, a native of Jamaica.

**TIPPERARY**, a county of Ireland, in the province of Munster, lying between King's-county on the north, and Waterford on the south.

**TIPSTAFF**, an officer who attends the judges with a kind of staff tipped with silver, and takes into his charge all prisoners who are committed or turned over at a judge's chambers.

**TIRE**, in the sea-language, is a row of cannon placed along a ship's side, either above upon deck, or below, distinguished by the epithet of upper and lower tires.

**TIROL**, a country of Germany, in the circle of Austria, about one hundred and twenty miles long, and sixty broad, subject to the house of Austria: it is bounded by Swabia and Bavaria on the north.

**TITANS**, in the heathen mythology, the offspring of Titan, the elder brother of Saturn; upon whom, and his son Jupiter, they made war, in order to recover the sovereignty of which Titan had been deprived. The poets represent them as a race of giants, sprung from the earth, and invading heaven; and tell us, that Jupiter overcame them with thunder, and drove them down to the very bottom of hell.

**TITHES**. See **TIEND**.

**TITLE**, an appellation of dignity or quality, given to princes, and other persons of distinction.

**TITMOUSE**, in ornithology. See **PARUS**.

**TITUBATION**, a kind of libration, or shaking, which the ancient astronomers attributed to the crystalline heavens, in order to account for certain irregularities which they observed in the motions of the planets.

**TITULAR**, denotes a person invested with a title, in virtue of which he holds an office or benefice, whether he perform the functions thereof or not.

**TINERTON**, a borough of Devonshire, situated on the river Ex, thirteen miles north of Exeter. It sends two members to parliament.

**TIVOT**, or **CHEVIOT-MOUNTAINS**, are high hills on the borders of England and Scotland.

**TMESIS**, in grammar, a figure whereby a compound word is separated into two parts, and one or more words placed between them: thus, for *quacunqna*, Virgil says, *quæ me cunqus vocant terra*, &c.

**TOAD**, in zoology. See **RANA**.

**TOAD FLAX**, in botany. See **ANTIRRHINUM**.

**TOBACCO**, in botany. See **NICOTIANA**.

**TOBAGO**, a small island in the bay of Panama, in South-

- South-America, situated W. long  $82^{\circ}$ , N. lat.  $8^{\circ}$ .
- TOBAGO**, is also the name of one of the Caribbee islands.
- TOBOLSKI**, the capital of Siberia, situated at the confluence of the rivers Tobal and Iris: E. long.  $63^{\circ}$ , N. lat.  $57^{\circ} 30'$ .
- TOCAT**, the capital of Amasia, in Asia: E. long.  $37^{\circ}$ , and N. lat.  $41^{\circ} 30'$ .
- TOCKAY**, a city of Hungary, seventy miles north-east of Buda, the wines of which are esteemed the best in Europe.
- TOES**. See **ANATOMY**, p. 188.
- TOGA**, in Roman antiquity, a wide woolen gown, or mantle; which seems to have been of a semi-circular form, without sleeves; differing both in richness and largeness, according to the circumstances of the wearer, and used only upon occasion of appearing in public.
- Every body knows that the toga was the distinguishing mark of a Roman: hence, the *jus togæ*, or privilege of the toga, was the same with the privilege of a Roman citizen, *i. e.* the right of wearing a Roman habit, and of taking, as they explain it, fire and water through the Roman empire.
- TOILS**, snares or nets used by hunters for catching wild beasts, as deer, &c.
- TOILET**, a fine cloth of linen, silk, or tapestry, spread over the table in a bed-chamber or dressing room, to undress and dress upon.
- TOISE**, a French measure containing six of their feet; or a fathom.
- TOLEDO**, a city of New Castile, in Spain; the archbishop of which is primate of Spain, &c. and possesses the largest revenue of any archbishop of Europe: it is situated in W. long.  $4^{\circ} 12'$ , and N. lat.  $39^{\circ} 45'$ .
- TOLÉN**, the capital of an island of the same name, in the province of Zealand, in the united Netherlands, situated four miles north-west of Bergenpzoom.
- TOLERATION**, in matters of religion, is either civil or ecclesiastical. Civil toleration, is an immunity and safety granted by the state to every sect that does not maintain doctrines inconsistent with the public peace; and ecclesiastical toleration, is the allowance which the church grants to its members to differ in certain opinions not reputed fundamental.
- TOLLENON**, among the Romans, a warlike machine, formed in this manner: One beam was fixed very deep in the earth, and on the top of it another more than twice as long, and moveable upon a centre; on one end of this cross-beam were placed a covering of hurdles or planks, within which a few soldiers were put, and by pulling down the other end with ropes, these were raised above the walls of a besieged town.
- TOLU**, a port-town of Terra Firma, situated on a bay of the North-Sea, an hundred miles south-west of Carthage.
- TOLUIFERA**, in botany, a genus of the decandria monogynia class. The calix is bell-shaped, and has five segments; the corolla has five petals, the lowest being longest, and somewhat cordated; it has no stylus. There is but one species, a native of America.
- TOMB**, includes both the grave or sepulchre wherein a defunct is interred, and the monument erected to preserve his memory.
- TOME**, in matters of literature, denotes a bound book, or writing that just makes a volume.
- TOMENTUM**, among botanists, the downy matter which grows on the leaves of some plants.
- TONE**, or **TUNE**, in musick, a property of sound, whereby it comes under the relation of grave and acute; or it is the degree of elevation a sound has, from the degree of swiftness of the vibrations of the part of sonorous bodies. See **MUSICK**.
- TONGUE**, in anatomy. See **ANATOMY**, p. 304.
- TONQUIN**, a kingdom of the fur her India, bounded by the provinces of Yunam and Canton, in China, on the north; by Cochin China, on the south; and by the kingdom of Laos, on the west; lying between  $101^{\circ}$  and  $108^{\circ}$  E. long. and between  $17^{\circ}$  and  $26^{\circ}$  N. lat. Its capital is Keccio, or Cachao.
- TONSILS**, in anatomy. See **ANATOMY**, p. 303.
- TONSURE**, in ecclesiastical history, a particular manner of shaving or clipping the hair of ecclesiastics or monks.
- The ancient tonsure of the clergy was nothing more than polling the head, and cutting the hair to a moderate degree, for the sake of decency and gravity; and the same observation is true, with respect to the tonsure of the ancient monks. But the Romanists have carried the affair of tonsure much farther; the candidate for it kneeling before the bishop, who cuts the hair in five different parts of the head, *viz.* before, behind, on each side, and on the crown.
- TOOL**, among mechanics, denotes in general any small instrument, used as well for making other more complex instruments and machines, as in most operations in the mechanic arts.
- TOOTH**, in anatomy. See **ANATOMY**, p. 164.
- TOOTH ACH**. See **MEDICINE**, p. 120.
- TOPARCHY**, a little state or feigniory, consisting only of a few cities or towns; or a petty country, governed and possessed by a toparch or lord.
- TOPAZ**, in natural history, a gem called by the ancients chrysolite, as being of a gold-colour.
- The topaz, when perfect and free from blemishes, is a very beautiful and valuable gem; it is, however, very rare in this state. It is of the number of those gems which are found only in the round or pebble form, there never having been yet seen a true and genuine topaz of a columnar figure, though the far greater part of what our jewellers call such, are in that form. The greater part of the true topazes are no larger than grains of a coarse seed; among these there are, however, some met of the size of a pea, and some much larger, though these are very rare. It is of a roundish or oblong figure in its native or rough state, and is usually flatted on one side, and is generally of a bright and naturally polished surface, tolerably transparent. They are ever of a fine yellow colour; but they have this, like the other gems, in several different degrees: the finest of all are of a true and perfect gold colour; but there are some much deeper, and others extremely pale, so as to appear scarce tinged. The oriental topaz is equal to the ruby in hardness, and is second only to the diamond in lustre.
- TOPHUS**, in medicine, denotes a chalky or stony concretion in any part of the body, as the bladder, kidney, &c. but especially in the joints.

**TOPICAL MEDICINES**, are the same with external ones, or those applied outwardly to some diseased and painful part: such are plasters, cataplasms, unguents, &c.

**TOPOGRAPHY**, a description or draught of some particular place, or small track of land; as that of a city or town, manor or tenement, field, garden, house, cattle, or the like; such as surveyors set out in their plots, or make draughts of, for the information and satisfaction of the proprietors.

**TORBAY**, a fine bay in the English channel, a little east of Dartmouth.

**TORCELLA**, a port town of Catalonia, in Spain, situated at the mouth of the river Ter, in E. long.  $2^{\circ} 50'$ , and N. lat.  $42^{\circ}$ .

**TORCH**, a luminary used in several church-ceremonies, funerals, &c. and more usually called flambeau.

**TORCH-THRISTLE**, in botany. See **CACTUS**.

**TORDYLIUM**, in botany, a genus of the pentandria digynia class. The radii of the corolla are all hermaphrodites; the fruit is roundish, with a crenated edge; and the involucre are long, and undivided. There are seven species, only two of them natives of Britain, viz. the latifolium, or purple-flowered great bastard parsley; and the nodosum, or knotted parsley.

**TORUS**, is architecture, a large round moulding, used in the bases of columns.

**TORIES**, in the history of England, a faction or party, opposed to the whigs. See **WHIGS**.

The tories are great sticklers for the prerogative of the crown, as the whigs are for the liberties and privileges of the people; though, in truth, the principles of the moderate people of both parties do not greatly differ.

**TORMENTILLA**, in botany, a genus of the icofandria polygynia class. The calix consists of eight segments, and the corolla of four petals; the seeds are roundish, naked, and fixed to a small dry receptacle. There are two species, both natives of Britain, viz. the erecta, or tormentil; and the reptans, or creeping tormentil.

Tormentil-root has an austere styptic taste, accompanied with an aromatic flavour: it is one of the most agreeable and efficacious vegetable astringents.

**TORNADO**, a sudden and vehement gust of wind from all points of the compass, frequent on the coast of Guinea.

**TORNE**, the capital of Torne Lapmark, a province of Sweden, situated at the mouth of the river Torne, at the bottom of the Bothnic gulph, upon a little island made by the river, four hundred miles north of Stockholm: E. long.  $22^{\circ} 45'$ , N. lat.  $65^{\circ} 45'$ .

**TORPEDO**, in ichthyology. See **RAJA**.

**TORQUE**, in heraldry, denotes a round roll of cloth, twisted and stuffed: such is the bandage, frequently seen in armories, about the heads of moors, &c.

**TORREFACTION**, in chemistry, is the roasting or scorching of a body by the fire, in order to discharge a part either unnecessary or hurtful in another operation; as sulphur is thus discharged from an ore, before the metal can be obtained to advantage.

**TORRENT**, denotes a temporary stream of water, falling suddenly from mountains, whereon there have been great rains, or an extraordinary thaw of snow.

**TORRICELLIAN EXPERIMENT**, a famous experiment made by Toricelli, a disciple of the great Galileo, which

has been already explained in the Treatise of PNEUMATICS, p. 485.

**TORRINGTON**, a market-town of Devonshire, situated on the river Towbridge, twenty six-miles north-west of Exeter.

**TORTOISE**, in zoology. See **TESTUDO**.

**TORTURE**, a grievous pain inflicted on a criminal, or person accused, to make him confess the truth.

**TOTNESS**, a borough-town of Devonshire, twenty-three miles south-west of Exeter. It sends two members to parliament.

**TOUCAN**, in ichthyology. See **RAMPHASTOS**.

**TOUCAN**, in astronomy, p. 487.

**TOUCH-NEEDLE**, among assayers, refiners, &c. little bars of gold, silver, and copper, combined together in all the different proportions and degrees of mixture; the use of which is to discover the degree of purity of any piece of gold or silver, by comparing the mark it leaves on the touch stone with those of the bars.

The metals usually tried by the touch-stone, are gold, silver, and copper, either pure, or mixed with one another in different degrees and proportions, by fusion. In order to find out the purity or quantity of baser metal in these various admixtures, when they are to be examined they are compared with these needles, which are mixed in a known proportion, and prepared for this use. The metals of these needles, both pure and mixed, are all made into laminæ or plates, one twelfth of an inch broad, and of a fourth part of their breadth in thickness, and an inch and half long; these being thus prepared, you are to engrave on each a mark indicating its purity, or the nature and quantity of the admixture in it.

The black rough marbles, the basaltes, or the softer kinds of black pebbles, are the most proper for touch-stones.

Now the method of using the needles and stone is this: the piece of metal to be tried, ought first to be wiped well with a clean towel, or piece of soft leather, that you may the better see its true colour; for from this alone an experienced person will, in some degree, judge beforehand what the principal metal is, and how and with what debased.

Then chuse a convenient, not over large, part of the surface of the metal, and rub it several times very hardly and strongly against the touch-stone, that in case a deceitful coat or crust should have been laid upon it, it may be worn off by that friction: this, however, is more readily done by a grind-stone, or small file. Then wipe a flat and very clean part of the touch-stone, and rub against it, over and over, the just mentioned part of the surface of the piece of metal, till you have, on the flat surface of the stone, a thin metallic crust, an inch long, and about an eighth of an inch broad: this done, look out the needle that seems most like to the metal under trial, wipe the lower part of this needle very clean, and then rub it against the touch-stone, as you did the metal, by the side of the other line, and in a direction parallel to it.

When this is done, if you find no difference between the colours of the two marks, made by your needle and the metal under trial, you may with great probability pronounce that metal and your needle to be of the same alloy, which is immediately known by the mark engraved

on your needle. But if you find a difference between the colour of the mark given by the metal, and that by the needle you have tried, choose out another needle, either of a darker or lighter colour than the former, as the difference of the tinge on the touch-stone directs; and by one or more trials of this kind you will be able to determine which of your needles the metal answers, and thence what alloy it is of, by the mark of the needle; or else you will find that the alloy is extraordinary, and not to be determined by the comparison of your needles.

**TOURINE**, a town of the bishopric of Liege, thirteen miles north-east of Namur.

**TOURNEY**, a city of Flanders, in the Austrian Netherlands, situated on the river Scheld, thirteen miles east of Lille: E. long  $3^{\circ} 30'$ , and N. lat.  $50^{\circ} 37'$ .

**TOURNEFORTIA**, in botany, a genus of the pentandria monogynia class. The berry has two cells containing two seeds, perforated with two holes at the apex. There are eight species, none of them natives of Britain.

**TOURNEQUET**, in surgery, an instrument made of rollers, compresses, screws, &c. for compressing any wounded part, so as to stop hæmorrhages. See **SURGERY**.

**TOWER**, a tall building, consisting of several stories, usually of a round form, though sometimes square or polygonal.

Towers are built for fortresses, prisons, &c. as the Tower of London, the Tower of the Bastile, &c.

**TOWN**, a place inhabited by a considerable number of people, being of a middle size between a city and village.

**TOXICODENDRON**, in botany. See **RHUS**.

**TOZZIA**, in botany, a genus of the didynamia angiospermia class. The calix has five teeth; and the capsule is round, with one cell, containing a single seed. There is but one species, a native of Switzerland.

**TRACHEA**, in anatomy. See **ANATOMY**, p. 300.

**TRACHELIUM**, in botany, a genus of the pentandria monogynia class. The corolla is funnel-shaped; the stigma is globular; and the capsule has three cells. There is but one species, a native of Italy.

**TRACHINUS**, in ichthyology, a genus belonging to the order of Jugularis. The head is small, smooth, and compressed; there are six rays in the membrane of the gills; the plates of the opercula are serrated; and the anus is near the breast. There is but one species, viz. the draco, a native of the northern ocean.

**TRACT**, in geography, an extent of ground, or a portion of the earth's surface.

**TRACT**, in matters of literature, denotes a small treatise, or written discourse upon any subject.

**TRADE**. See **COMMERCE**.

**TRADE-WINDS**. See **PNEUMATICS**, p. 495.

**TRADESCANTIA**, in botany, a genus of the hexandria monogynia class. The calix consists of three leaves, and the corolla of three petals; the filaments are villous; and the capsule has three cells. There are three species, all natives of warm countries.

**TRADITION**, among ecclesiastical writers, denotes certain regulations regarding the rites, ceremonies, &c. of religion, which we suppose to have been handed down from the days of the apostles to the present time.

**TRADITION**, in Scots law. See **LAW**, Tit viii. 10.

**TRAFFIC**. See **COMMERCE**.

**TRAGACANTH**, in botany. See **ASTRACALUS**.

Gum-tragacanth is the produce of this shrub, which grows to about four feet high, and has a firm and robust stem, with numerous branches. The gum is brought to us in long and slender pieces, of a flattened figure, more or less; and these not straight, or rarely so; but commonly twisted and contorted various ways, so as to resemble worms.

Tragacanth has the same virtues with gum-arabic, but in a greater degree. It greatly inspissates and obtunds the acrimony of the humours, and is therefore found of vast service in inveterate coughs, and other disorders of the breast.

**TRAGEDY**, a dramatic poem, representing some signal action performed by illustrious persons, and which has frequently a fatal issue, or end. See **COMPOSITION**.

**TRAGI-COMEDY**, a dramatic piece partaking of the nature both of tragedy and comedy; the event whereof is not bloody or unhappy, and wherein is admitted a mixture of less serious characters.

**TRAGIA**, in botany, a genus of the monœcia tetrandria class. The calix of the male consists of three segments, that of the female of five; neither of them have any corolla; the stylus is trifid; and the capsule has three cells, with solitary seeds. There are five species, none of them natives of Britain.

**TRAGOPOGON**, in botany, a genus of the syngenesia polygamia æqualis class. The receptacle is naked; the calix is simple, and consists of many leaves; and the pappus is feathered. There are eleven species, two of them natives of Britain, viz. the pratense, or yellow goat's-beard; and the porifolium, or purple goat's-beard.

**TRAGUS**, in anatomy. See **ANATOMY**, p. 295.

**TRAJAN COLUMN**, a famous historical column erected in Rome, in honour of the emperor Trajan. It is of the Tuscan order, though something irregular; its height is eight diameters, and its pedestal Corinthian: it was built in a large square there, called Forum Romanum. Its base consists of twelve stones, of an enormous size, and it is raised on a socle, or foot of eight steps; within side is a stair-case, illuminated with forty four windows. It is 140 feet high, which is thirty-five short of the Antonine column, but the workmanship of the former is much more valued. It is adorned from top to bottom with basso-relievo's, representing the great actions of that emperor against the Dacæ.

**TRAJECTORY** of a comet, is its path or orbit, or the line it describes in its motion. See **ASTRONOMY**, p. 444.

**TRAIN**, a line of gun-powder, said to give fire to a quantity thereof, in order to do execution by blowing up earth, works, buildings, &c.

**TRAIN OF ARTILLERY**, includes the great guns, and other pieces of ordnance belonging to an army in the field.

**TRAIN-OIL**, the oil procured from the blubber of a whale by boiling.

**TRAINING**, or **TRACING**, in mineralogy, a term used by the miners, to express the tracing up the mineral appearances on the surface of the earth to their head, or original place, and there finding a mine of the metal they contain. See **MINE**.

**TRALOS MONTES**, a province of Portugal, bounded by Spain on the north-east; by the province of Beira on the south; and by Entreminho Douro on the west.

**TRANSACTION**, an accommodation of some business,

- or dispute between two parties, by a mutual and voluntary agreement between them.
- TRANSCENDENTAL**, or **TRANSCENDANT**, something elevated, or raised above other things; which passes and transcends the nature of other inferior things.
- TRANSCRIP T**, a copy of any original writing, particularly that of an act, or instrument, inserted in the body of another.
- TRANSFER**, in commerce, &c. an act whereby a person surrenders his right, interest, or property in any thing moveable or immovable to another.
- TRANSFORMATION**, in general, denotes a change of form, or the assuming a new form different from a former one. The chemists have been for a long time seeking the transformation of metals; that is, their transmutation, or the manner of changing them into gold.
- TRANSFERENCE**, in Scots law. See *LAW*, Tit. xxx. 25.
- TRANSFUSION**, the act of pouring a liquor out of one vessel into another.
- TRANSGRESSION**, an offence against some law, or a breach or violation thereof.
- TRANSILVANIA**, a principality bounded by the Carpathian mountains, which divide it from Poland on the north; by Moldavia on the east; by Walachia, and part of Hungary, on the south; and by another part of Hungary on the north; being about 120 miles long, and almost as many broad; and lying between 22 and 25 degrees east long, and between 45 and 48 of north lat.
- TRANSIT**, in astronomy, signifies the passage of any planet, just by, or over a fixed star, or the sun, and of the moon in particular, covering or moving over any planet. See *ASTRONOMY*, p. 438.
- TRANSITIVE**, in grammar, an epithet applied to such verbs as signify an action which passes from the subject that does it, to or upon another subject which receives it. Under the head of verbs transitive, come what we usually call verbs active and passive; other verbs, whose action does not pass out of themselves, are called neuters.
- TRANSLATION**, the act of transferring or removing a thing from one place to another; we say the translation of a bishop's see, a council, a seat of justice, &c.
- TRANSLATION** is also used for the version of a book or writing out of one language into another.
- TRANSMARINE**, something that comes from, or belongs to, the parts beyond sea.
- TRANSMIGRATION**, the removal or translation of a whole people into another country, by the power of a conqueror.
- TRANSMIGRATION**, is particularly used for the passage of a soul out of one body into another, being the same with what we otherwise call metempsychosis. See *METEMPSYCHOSIS*.
- TRANSMUTATION**, the act of transforming or changing one nature into another.
- TRANSMUTATION**, in alchemy, denotes the art of changing or exalting imperfect metals into gold or silver. This is also called the grand operation, and, they say, is to be effected with the philosopher's stone.
- TRANSOM**, among builders, denotes the piece that is framed across a double light window.
- TRANSOM**, in a ship, a piece of timber which lies athwart the stern, between the two fashion-pieces, directly under the gun-room port. See *SHIP-BUILDING*.
- TRANSPARENCY**, in physics, a quality in certain bodies, whereby they give passage to the rays of light; in contradistinction to opacity, or that quality of bodies which renders them impervious to the rays of light.
- TRANSPIRATION**, the insensible, or almost insensible, passage of an excrementitious matter through the pores of the skin, called also perspiration.
- TRANSPLANTATION**, in agriculture and gardening, the act of removing trees or plants from the places where they were sowed, or raised, and planting them in others.
- TRANSPORTATION**, the act of conveying or carrying a thing from one place to another.
- TRANSPOSITION**, in grammar, a disturbing or dislocating of the words in a discourse, or a changing of their natural order of construction, to please the ear by rendering the contexture more easy, smooth, and harmonious.
- TRANSPOSITION**, in musick See *MUSICK*.
- TRANSUBSTANTIATION**, in theology, the conversion or change of the substance of the bread and wine in the eucharist, into the body and blood of Jesus Christ, which the Romish church hold is wrought by the consecration of the priest
- Action of* **TRANSMUMPT**, in Scots law. See *LAW*, Tit. xxx. 27.
- TRANSVERSALIS**, in anatomy. See *ANATOMY*, p. 193.
- TRANSVERSE**, something that goes across another, from corner to corner: thus bends and bars, in heraldry, are transverse pieces or bearings: the diagonals of a parallelogram or a square, are transverse lines.
- TRAPA**, in botany, a genus of the tetrandria monogynia class. The corolla consists of four petals; and the calix of four segments; and the nut has four spines opposite to one another. There is but one species, a native of Asia.
- TRAPEZIUM**, in geometry, a plane figure contained under four unequal right lines.
- TRAPEZIUS**, in anatomy. See *ANATOMY*, p. 193.
- TRAVERSE**, or **TRANSVERSE**, in general, denotes something that goes athwart another; that is, crosses and cuts it obliquely.
- TRAVERSE**, in navigation, is a compound course, wherein several different successive courses and distances are known. See *NAVIGATION*.
- TRAVESTY**, a French term, derived from the verb *travestir*, to disguise one's self, or to appear in masquerade: and hence, travesty is applied to the disfiguring of an author, or the translating him into a style and manner different from his own, by which means it becomes difficult to know him.
- TREACLE**. See *THERIACA*.
- Some also give the name treacle to melasses.
- TREASON**, in general, signifies betraying; but is more particularly used for the act or crime of infidelity to one's lawful sovereign. See *LAW*, Tit. xxxiii. 9.
- TREASURE**, in general, denotes a store or stock of money in reserve.
- TREASURER**, an officer to whom the treasure of a prince or corporation is committed, to be kept, and duly disposed of.
- The lord high treasurer of Great Britain, or first commissioner of the treasury, when in commission, has under his charge and government all the kings revenue, which is kept in the exchequer. He holds his place during the king's pleasure, being instituted by the delivery of a white staff

- staff to him : he has the check of all the officers employed in collecting the customs and other royal revenues ; and in his gift and disposition are all the officers of the customs in the several ports of the kingdom ; escheators in every county are nominated by him ; he also makes leases of the lands belonging to the crown.
- TREASURY**, the place wherein the revenues of a prince are received, preserved, and disbursed.
- Lords of the TREASURY.* In lieu of one single director and administrator of his majesty's revenues under the title of lord high treasurer, it is at present thought proper to put that office in commission, *i. e.* to appoint several persons to discharge it with equal authority, under the title of lords commissioners of the treasury.
- TREATISE**, a set discourse in writing on any subject. A treatise is supposed more express, formal, and methodical than an essay, but less for than a system.
- TREATY**, a covenant between two or more nations ; or the several articles or conditions stipulated and agreed upon between sovereign powers.
- TREBLE**, in musick, the highest or acutest of the four parts in symphony, or that which is heard the clearest and shrillest in a concert.
- TREE**, the first and largest of the vegetable kind, consisting of a single trunk, out of which spring forth branches and leaves.
- TREFOIL. See **TRIFOLIUM.****
- Marsh-TREFOIL*, in botany. See **MENYANTHES.**
- Shrub-TREFOIL*, in botany. See **CYTISUS.**
- TREMELLA**, **LAVER**, in botany, a genus of sea-plants, of a middle nature, between the alga and conserva, being of a pellucid and membranaceous, and frequently of a gelatinous structure. There are nine species, six of them natives of Britain.
- TREMOR**, an involuntary shaking, chiefly of the hands and head, sometimes of the feet, and sometimes of the tongue and heart.
- TRENCHES**, in fortification, are ditches cut by the besiegers, that they may approach more securely to the place attacked ; whence they are also called lines of approach.
- TRENT BISHOPRICK**, a province of Germany, in the circle of Austria, situated on the Alps, which divides Italy from Germany, and sometimes reckoned part of Italy ; it is bounded by Tyrol on the north, by the territory of Venice on the east and south, and by the country of the Grisons on the west, being seventy miles long and fifty broad, subject to the house of Austria.
- TRENT** is also the name of one of the largest rivers in Great Britain, rising in the moor-lands of Staffordshire, and running south-east by Newcastle Under Line, divides that country almost into two equal parts ; then entering Derbyshire, turns about to the north-east ; and having run the whole length of Nottinghamshire, continues its course due north ; at last joining the river Ouse, and several others, it changes its name to that of Humber, and falls into the German sea below Hull.
- TREPAN. See **SURGERY**, p. 664.**
- TREPANNING**, in surgery. See **SURGERY**, *ibid.*
- TRESPASS**, in law, signifies any transgression of the law, under treason, felony, or misprison of either ; but it is most commonly used for any wrong or damage that is done
- by one private person to another, or to the king in his forest, &c.
- TRESSURE**, in heraldry, a diminutive of an orle, usually held to be half the breadth thereof. See it represented in Plate CXLVII. fig. 20.
- TRET**, in commerce, an allowance made for the waste, or the dirt, that may be mixed with any commodity, which is always four pounds in every one hundred and four pounds weight
- TRIAL**, in law, the examination of a cause, civil or criminal, according to the laws of the land, before a proper judge : or, it is the manner and order observed in the hearing and determining of causes.
- TRIANDRIA**, in botany. See **BOTANY**, p. 635.
- TRIANGLE**, in geometry, a figure of three sides and three angles. See **GEOMETRY**, p. 686.
- TRIANGULARIS**, in anatomy. See **ANATOMY**, p. 306.
- TRIBE**, in antiquity, a certain quantity or number of persons, when a division is made of a city or people into quarters or districts.
- TRIBRACHYS**, in ancient poetry, a foot consisting of three syllables, and those all short ; as *melius*.
- TRIBULUS**, in botany, a genus of the decandria monogynia class. The calix consists of five segments, and the corolla of five open petals ; it has no stylus ; and there are five gibbous, bristly capsules, containing many seeds. There are four species, none of them natives of Britain.
- TRIBUNAL**, in general, denotes the seat of a judge, called in our courts *bench*.
- TRIBUNE**, among the ancient Romans, a magistrate chosen out of the commons, to protect them against the oppressions of the great, and to defend the liberty of the people against the attempts of the senate and consuls.
- The tribunes of the people were first established in the year of Rome 259. The first design of the creation was to shelter the people from the cruelty of usurers, and to engage them to quit the Aventine mount, whither they had retired in displeasure.
- Their number, at first, was but two ; but the next year, under the consulate of A. Posthumus Aruncius and Cassius Viscellitus, there were three more added ; and this number of five was afterwards increased by L. Trebonius to ten. The appellation *tribune* was given them, by reason they were at first chosen out of the tribunes of the army.
- Military TRIBUNE*, an officer in the Roman army, who commanded in chief over a body of forces, particularly the division of a legion, much the same with our colonel, or the French *meistre de camp*.
- TRIBUTARY**, one who pays tribute to another, in order to live in peace with him, or share in his protection.
- TRIBUTE**, a tax or impost which one prince or state is obliged to pay to another as a token of dependence, or in virtue of a treaty, and as a purchase of peace.
- TRICEPS**, in anatomy. See **ANATOMY**, p. 205.
- TRICHOSTEMA**, in botany, a genus of the didynamia gymnospermia class. The upper lip of the corolla is falcated ; and the stamina are very long. There are two species, both natives of America.
- TRICUSPIDES VALVE**, in anatomy. See **ANATOMY**, p. 279.

TRIDENT, an attribute of Neptune, being a kind of sceptre which the painters and poets put into the hands of that god, in form of a spear, or fork, with three teeth; whence the word.

TRIEMIMERIS, a kind of cæsura in Latin verse, wherein after the first foot of the verse there remains an odd syllable, which helps to make up the next foot.

TRIENNIAL, an epithet applied chiefly to offices or employments which last for three years.

TRIENS, in antiquity, a copper money of the value of one third of an as, which on one side bore a Janus's head, and on the other a water-rat.

TRIENTALIS, in botany, a genus of the heptandria monogynia class. The calix consists of seven leaves, and the corolla of seven equal plane segments; and the berry is dryish. There are two species, none of them natives of Britain.

TRIERS, or TREVES, the capital of the electorate of Triers in Germany, situated on the river Moselle, sixty miles south of Cologne: E. long.  $6^{\circ} 10'$ , N. lat.  $49^{\circ} 55'$ .

TRIESTE, a port-town of Istria, situated on the gulph of Venice, sixty miles north-east of that city.

TRIFOLIUM, in botany, a genus of the diadelphia decandria class. The flowers are subcapitated; the pod is hardly longer than the calix, and deciduous. There are 43 species, 16 of them natives of Britain.

TRIGA, in antiquity, denotes a kind of carr, or chariot, drawn by three horses; whence the name.

TRIGLA, in ichthyology, a genus of fishes, belonging to the order of thoracica. The head is loricated with rough lines, and there are seven rays in the membrane of the gills; There are nine species.

TRIGLOCHIN, in botany, a genus of the hexandria trigynia class. The calix consists of three leaves, and the corolla of three petals; and it has no stylus. There are two species, both natives of Britain, viz. the palustre, or arrow-headed grass; and the maritimum, or sea spiked grass.

TRIGLYPHS, in architecture, a sort of ornaments repeated at equal intervals in the Doric frieze.

TRIGONELLA, in botany, a genus of the diadelphia decandria class. The vexillum and alæ are nearly equal, open, and in the form of a corolla, with three petals. There are 10 species, none of them natives of Britain.

## T R I G O N O M E T R Y.

TRIGONOMETRY is that part of geometry which teaches how to measure the sides and angles of triangles.

Trigonometry is either plane or spherical, according as the triangles are PLANE or SPHERICAL; of each whereof we shall treat in order.

### PLANE TRIGONOMETRY.

PLANE Trigonometry, or that which teaches the mensuration of plane triangles, is commonly divided into *rectangular* and *oblique-angular*.

#### OF RECTANGULAR PLANE TRIGONOMETRY.

If in any right-angled triangle, ABC, (Plate CLIX. fig. 1. n<sup>o</sup> 1.) the hypotenuse be made the radius, and with that a circle be described on the one end, A, as a centre; then, it is plain, that BC will be the sine of the angle BAC; and if with the same distance, and on the end B as a centre, a circle be described, it is plain, that AC will be the sine of the angle ABC; therefore, in general, if the hypotenuse of a right-angled triangle be made the radius, the two legs will be the sines of their opposite angles.

Again, if in a right-angled triangle DEF (*ibid.* n<sup>o</sup> 2.) one of the legs, as DF, be made the radius, and on the extremity D (at one of the oblique angles, viz. that which is formed by the hypotenuse and the leg made radius) as a centre, a circle be described; it is plain, that the other leg, EF, will be the tangent of the angle at D, and the hypotenuse DE will be the secant of the same angle. The same way, making the leg EF the radius, and on the center E describing a circle, the other leg DF will become the tangent of the angle at E, and the hypotenuse DE the secant of the same.

The chord, sine, tangent, &c. of any arch, or angle, in

one circle, is proportionable to the chord, sine, tangent, &c. of the same arch in any other circle: from which, and what has been said above, the solutions of the several cases of rectangular trigonometry naturally follow.

Since trigonometry consists in determining angles and sides from others given, there arise various cases; which being seven in rectangular trigonometry, are as follow.

CASE I. The angles, and one of the legs, of a right-angled triangle being given; to find the other leg.

EXAMPLE. In the triangle ABC (*ibid.* n<sup>o</sup> 3.) right-angled at B, suppose the leg AB=86 equal parts, as feet, yards, miles, &c. and the angle A=33<sup>o</sup> 40'; required the other leg BC, in the same parts with AB.

I. *Geometrically*: Draw AB=86, from any line of equal parts; upon the point B, erect the perpendicular BC; and, lastly, from the point A, draw the line AC, making with AB an angle of 33<sup>o</sup> 40'; and that line produced will meet BC in C, and so constitute the triangle. The length of BC may be found by taking it in your compasses, and applying it to the same line of equal parts that AB was taken from.

II. *By calculation*: First, by making the hypotenuse AC radius, the other two legs will be the sines of their opposite angles, viz. AB the sine of C, and CB the sine of A. Now since the sine, tangent, &c. of any arch in one circle is proportionable to the sine, tangent, &c. of the same arch in any other circle, it is plain the sines of the angles A and C in the circle described by the radius AC, must be proportional to the sine of the same arches or angles, in the circle, that the table of artificial sines, &c. was calculated for; so the proportion for finding BC will be

$$S, C : AB :: S, A : BC$$

i. e. as the sine of the angle C in the tables, is to the length of AB (or sine of C in the circle whose radius is AC), so is the sine of the angle A in the tables, to the length of

BC

BC (or sine of the same angle in the circle whose radius is A C.) Now the angle A being  $33^{\circ} 40'$ , the angle C must be  $56^{\circ} 20'$ ; therefore looking in the table of artificial sines, &c. for the sines of the two angles, and in the table of logarithms for the logarithm of 86 the given leg, we shall find, by proceeding according to the foregoing proportion, that the required leg BC is 57.28; and the operation will stand as follows:

1.93450	AB	86
9.74380	S, A	$33^{\circ} 40'$
<hr/>		
11.67830		
9.92027	S, C	$56^{\circ} 20'$
<hr/>		
1.75803	BC	57.28

Secondly, making AB the radius, it is plain BC, the leg required, will be the tangent of the given angle A; and so the proportion for finding BC, when AB is made the radius, will be:

$$R : T, A :: AB : BC$$

*i. e.* as the radius in the tables, is to the tangent of the angle A in the same; so the length of BA, or radius in the scheme, to the length of BC or tangent of A in the scheme: therefore looking in the tables for the parts given in the foregoing proportion, and proceeding with them according to that rule, we shall find BC to be 57.28 as before, and the operation will be as follows:

9.82352	T, A	$33^{\circ} 40'$
1.93450	AB	86

11.75802	
10.00000	Rad. $90^{\circ}$

175802	BC	57.28
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Lastly, by making BC, the leg required, the radius, it is plain that AB will be the tangent of C, and the proportion for finding BC will be as follows:

$$T, C : R :: AB : BC$$

<i>i. e.</i> as the tangent of C	$56^{\circ} 20'$	10.17648
is to radius	$90^{\circ}$	10.00000
so is the length of AB	86	1.93450

to the length of BC  $57.28$  1.75802

CASE II. The angles and one of the legs given, to find the hypotenuse.

EXAMPLE: In the triangle ABC, (*ibid.* n<sup>o</sup> 4.) suppose AB 124, and the angle A  $34^{\circ} 20'$ ; consequently the angle C  $55^{\circ} 40'$ , required the hypotenuse AC, in the same parts with A B.

*I. Geometrically:* This case is constructed after the same manner with the former; and the hypotenuse, AC, is found, by taking its length in your compasses, and applying that to the same line of equal parts from which AB was taken.

*II. By calculation:* First, making AC the radius, we shall have the following proportion for finding AC, *viz.*

$$S, C : R :: AB : AC$$

<i>i. e.</i> as the sine of C	$55^{\circ} 40'$	9.91686
is to radius	$90^{\circ}$	10.00000
so is AB	124	2.09342
to AC	150.2	2.17656

Secondly, making AB the radius, we have this proportion, *viz.*

$$R : \sec. A :: AB : AC$$

<i>i. e.</i> as the radius	$90^{\circ}$	10.00000
to the secant of A	$34^{\circ} 20'$	10.08314
so is AB	124	2.09342
to AC	150.2	2.17656

This may also be done, without the help of the secants: for since  $R : \sec. :: Co-S. : R$ ; therefore, the former proportion will become,

$$Co-S, A : R :: AB : AC$$

<i>i. e.</i> as the co-sine of A	$54^{\circ} 20'$	9.91686
is to the radius	$90^{\circ}$	10.00000
so is AB	124	2.09342
to AC	150.2	2.17656

Thirdly, making BC the radius, we have the following proportion, *viz.*

$$T, C : \sec. C :: AB : AC$$

<i>i. e.</i> as the tangent of C	$55^{\circ} 40'$	10.16558
is to sec. C	$55^{\circ} 40'$	10.24872
so is AB	124	2.09342
to AC	150.2	2.17656

This likewise may be done without the help of secants; for since  $T, : \sec. :: S, : R$ ; therefore the former analogy will be reduced to this, *viz.*

$$S, C : R :: AB : AC$$

where no secants do appear; and it coincides with that in the first supposition of this case, so we shall not repeat the operation.

CASE III. The angles and hypotenuse given, to find either of the legs.

EXAMPLE. In the triangle ABC, (*ibid.* n<sup>o</sup> 4.) suppose the hypotenuse  $AC = 146$ , and the angle  $A = 36^{\circ} 25'$ ; consequently the angle  $C = 53^{\circ} 35'$ ; required the leg AB.

*I. Geometrically:* Draw the line AB at pleasure, and make the angle BAC equal to  $36^{\circ} 25'$ ; then take AC equal to 146 from any line of equal parts; lastly, from the point C, let fall the perpendicular CB, on the line AB. So the triangle is constructed, and AB may be measured from the line of equal parts.

*II. By calculation:* First, making AC the radius, we shall have the following proportion, *viz.*

$$R : S, C :: AC : AB$$

<i>i. e.</i> As radius	$90^{\circ}$	10.00000
to the sine of C	$53^{\circ} 35'$	9.90565
so is AC	146	2.16435
to AB	117.5	2.07000

Secondly, making AB the radius, we have the following analogy, *viz.*

$$\sec. A : R :: AC : AB$$

<i>i. e.</i> As the secant of A.	$36^{\circ} 25'$	10.09435
is to radius	$90^{\circ}$	10.00000
so is AC	146	2.16435
to AB	117.5	2.07000

This may also be done without the help of secants; for since  $\sec. : R :: R : Co-S$ , the former proportion may be reduced to this, *viz.*

$$R : Co-S, A :: AC : AB$$

which is the same with the proportion in the first supposition.

Thirdly, by supposing BC the radius, we have the following proportion, *viz.*

$$\sec. C : T, C :: AC : AB$$

<i>i. e.</i> as the secant of C	$53^{\circ} 35'$	10.22647
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is to the tangent of C	53° 35'	10.13212
fo is AC	146	2.16435
to AB	117.5	2.07000

CASE IV. The two legs being given, to find the angles.

EXAMPLE. In the triangle ABC, (*ibid.* n° 5.) suppose AB 94 and BC 56, required the angles A and C.

I. *Geometrically*: Draw AB equal to 94, from any line of equal parts; then from the point B raise BC perpendicular to AB, and take BC from the former line of equal parts equal to 56; lastly, join the points A and C with the straight line AC: so the triangle is constructed, and the angles may be measured by a line of chords.

II. *By calculation*: First, supposing AB the radius, we have this analogy, *viz.*

$$AB:BC::R:T, A,$$

<i>i. e.</i> as AB	94	1.97313
is to BC	56	1.74819
fo is the radius	90°	10.00000
to the tangent of A	30° 47'	9.77506

Secondly, making BC the radius, we have this proportion, *viz.*

$$BC:BA::R:T, C,$$

<i>i. e.</i> as BC	56	1.74819
is to AB	94	1.97313
fo is the radius	90°	10.00000
to the tangent of C	59° 13'	10.22494

CASE V. The hypotenuse and one of the legs given, to find the angles.

EXAMPLE. In the triangle DEF, (*ibid.* n° 6.) suppose the leg DE=83, and the hypotenuse DF=126; required the angles D and F.

I. *Geometrically*: Draw the line DE=83 from any line of equal parts; and from the point E raise the perpendicular EF: then take the length of DF=126, from the same line of equal parts; and setting one foot of your compasses in D, with the other crosses the perpendicular EF in E: lastly, join D and F; and the triangle being thus constructed, the angles may be measured by a line of chords.

II. *By calculation*: First, making DF the radius, we shall have this proportion, *viz.*

$$DF:DE::R:S, F,$$

<i>i. e.</i> as DF	126	2.10037
is to DE	83	1.91908
fo is radius	90°	10.00000
to the sine of F	41° 12'	9.81871

Secondly, by supposing DE the radius, we have the following analogy, *viz.*

$$DE:DF::R:Sec. D,$$

<i>i. e.</i> as DE	83	1.91908
is to DF	126	2.10037
fo is radius	90°	10.00000
to the secant of D	48° 48'	10.18129

This may be done without the help of secants; for since R: sec.: : Co-S.: R, the foregoing analogy will become this, *viz.*

$$DF:DE::R:Co-S, D,$$

which gives the same answer with that deduced from the first supposition.

CASE VI. The two legs being given, to find the hypotenuse.

EXAMPLE: In the triangle ABD, (*ibid.* n° 7.) suppose the leg AB=64, and BD=56: required the hypotenuse.

I. *Geometrically*: The construction of this case is performed the same way as in the fourth case, and the length of the hypotenuse is found by taking it in your compasses, and applying it to the same line of equal parts that the two legs were taken from.

II. *By calculation*: This case being a compound of the fourth and second cases, we must first find the angles by the fourth, thus:

$$AB:DB::R:T, A,$$

<i>i. e.</i> as the leg AB	64	1.80618
is to the leg DB	56	1.74819
fo is the radius	90	10.00000
to the tangent of A	41° 11'	9.94201

Then by the second case we find the hypotenuse required thus:

$$S, A:R::B D:A D,$$

<i>i. e.</i> as the sine of A	41° 11'	9.81854
is to the radius	90°	10.00000
fo is the leg BD	56	1.74819
to the hypoth. AD	85.05	1.92965

This case may also be solved after the following manner, *viz.*

From twice the logarithm of the greater side AB	3.61236
subtract the logarithm of the lesser side BD	1.74819

and there remains	1.86417
the logarithm of 73.15; to which adding the lesser side BD, we shall have 189.15, whose logarithm is	2.11093
to which add the logarithm of the lesser side BD	1.74819

and the sum will be 3.85912 the half of which is 1.92956 the logarithm of the hypotenuse required.

Or it may be done by adding the square of the two sides together, and taking the logarithm of that sum, the half of which is the logarithm of the hypotenuse required: thus, in the present case, the square of AB (64) is 4096 the square of BD (56) is 3136

the sum of these squares is 7232 the logarithm of which is 3.85926 the half of which is 1.92962= to the logarithm of 85.05, the length of the hypotenuse required.

CASE VII. The hypotenuse and one of the legs being given, to find the other leg.

EXAMPLE. In the triangle BGD, (*ibid.* n° 8.) suppose the leg BG=87, and the hypotenuse BD=142; required the leg DG.

I. *Geometrically*: The construction here is the same as in case V. the same things being given; and the leg DG is found by taking its length in your compasses, and applying that to the same line of equal parts the others were taken from

II. *By calculation*: The solution of this case depends upon the 1<sup>st</sup> and 5<sup>th</sup>; and first we must find the oblique angles by case 5<sup>th</sup> thus:

$$DB:BG::R:S, D,$$

<i>i. e.</i> as the hypoth. DB	142	2.15229
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is to the leg BG	87	1.93952
fo is radius	90°,	10.00000
to the sine of D	37°, 47'	97.8723
Then by case 1st. we find the leg DG required, thus:		
	R : S, B :: B D : D G,	
<i>i. e.</i> as radius	90°	10.00000
is to the sine of B	52°. 13'	9.89781
fo is the hypoth. DB	142	2.15229
to the leg DG	112.2	2.05010

The leg DG may also be found in the following manner, *viz.*

To the log of the sum of the hypotenuse and given leg, <i>viz.</i> 229	} 2.35984
add the logarithm of their difference, <i>viz.</i> 55	
	<hr/> 1174036

and their sum is 4.10020  
the half of that is 2.05010  
the log. of 112.2 the leg required.

Or it may be done by taking the square of the given leg from the square of the hypotenuse, and the square root of the remainder is the leg required: thus, in the present case,

The square of the hypotenuse (142) is	20164
The square of the leg BG (87) is	7569
	<hr/> 12595

Their difference is 12595  
Whose logarithm is 4.10020  
The half of whi h is 2.05010  
which answers to the natural number 112.2 the leg required.

Thus have we gone through the seven cases of right-angled plane trigonometry; from which we may observe, 1. That to find a side, when the angles are given, any side may be made the radius. 2. To find an angle, one of the given sides must of necessity be made the radius.

Of OBLIQUE-ANGLED PLANE TRIGONOMETRY.

In oblique-angled plane trigonometry there are six cases; but before we shew their solution, it will be proper to premise the following theorems.

**THEOREM I.** In any triangle ABC (*ibid* fig. 2. n° 2.) the sides are proportional to the sines of the opposite angles: thus, in the triangle ABC, AB : BC :: S, C : S, A, and AB : AC :: S, C : S B : also AC : BC :: S, B : S, A.

*Demonstration.* Let the triangle ABC be inscribed in a circle; then, it is plain (from the property of the circle) that the half of each side is the sine of its opposite angle: but the sines of these angles, in tabular parts, are proportional to the sines of the same in any other measure; therefore, in the triangle ABC, the sines of the angles will be as the halves of their opposite sides; and since the halves are as the wholes, it follows, that the sines of the angles are as their opposite sides; *i. e.* S, C : S, A :: AB : BC, &c.

**THEOR. II** In any plane triangle, as ABC (*ibid*. n° 2.) the sum of the sides, AB and BC, is to the difference of these sides, as the tangent of half the sum of the angles BAC, ABC, at the base, is to the tangent of half the difference of these angles.

*Demon.* Produce AB; and make BH equal to BC; join HC. and from B let fall the perpendicular BE; through B draw BD parallel to AC, and make HF equal to CD,

and join BF; also take BI equal to BA, and draw IG parallel to BD or AC.

Then it is plain that AH will be the sum, and HI the difference of the sides AB and BC; and since HB is equal to BC, and BE perpendicular to HC, therefore HE is equal to EC; and BD being parallel to AC and IG, and AB equal to BI, therefore CD or HF is equal to GD, and consequently HG is equal to FD, and half HG is equal to half FD or ED. Again, since HB is equal to BC, and BE perpendicular to HC, therefore the angle EBC is half the angle HBC; but the angle HBC is equal to the sum of the angles A and C, consequently the angle EBC is equal to half the sum of the angles A and C. Also, since HB is equal to BC, and HF equal to CD, and the included angles BHF BCD equal, it follows that the angle HBF is equal to the angle DBC, which is equal to BCA; and since HBD is equal to the angle A, and HBF equal to BCA, therefore FBD is the difference, and EBD half the difference of the two angles A and BCA: so making EB the radius, it is plain EC is the tangent of half the sum, and ED the tangent of half the difference of the two angles at the base. Now IG being parallel to AC, the triangles HIG and HAC will be equiangular; consequently AH : IH :: CH : GH; but the wholes are as their halves, therefore AH : IH ::  $\frac{1}{2}$ CH :  $\frac{1}{2}$ GH; and since  $\frac{1}{2}$ CH is equal to EC, and  $\frac{1}{2}$ GH equal to  $\frac{1}{2}$ FD=ED, therefore AH : IH :: EC : ED. Now AH is the sum, and IH the difference of the sides; also EC is the tangent of half the sum, and ED the tangent of half the difference of the two angles at the base; consequently, in any triangle, as the sum of the sides is to their difference, so is the tangent of half the sum of the angles at the base to the tangent of half their difference.

**THEOREM III.** If to half the sum of two quantities be added half their difference, the sum will be the greater of them; and if from half their sum be subtracted half their difference, the remainder will be the least of them. Suppose the greater quantity to be  $x=8$ , and the lesser  $z=6$ ; then is their sum 14, and difference 2:

$$\text{wherefore, adding } \frac{14}{2}=7 \text{ to } \frac{2}{2}=1, \text{ we}$$

get 8 the greatest of the two quantities:

$$\text{and, in the same manner, } \frac{14}{2}-\frac{2}{2}=7-$$

1=6, the least of the two quantities.

**THEOR. IV.** In any right-lined triangle, ABD (*ibid*. n° 3.) the base AD is to the sum of the sides AB and BD, as the difference of the sides is to the difference of the segments of the base made by the perpendicular BE, *viz.* the difference between AE ED.

*Demon.* Produce DB till BG be equal to BA the lesser leg; and on B as a centre, with the distance BA or BG, describe the circle AGHF, which will cut BD and AD in the points H and F; then it is plain GD is the sum, and HD the difference of the sides; also since AD is equal to EF, therefore FD is the difference of the segments of the base; but AD : GD :: HD : FD; therefore the base is to the sum of the sides, &c. as was to be proved.

Having established these preliminary theorems, we shall now proceed to the solution of the six cases of oblique-angled plane trigonometry.

**CASE I.** In any oblique-angled plane triangle, two sides 8 Q and

and an angle opposite to one of them being given, to find the angle opposite to the other.

EXAMPLE. In the triangle ABC (*ibid.* n<sup>o</sup> 4.) suppose AB=156, BC=84, and the angle C (opposite to AB)=56° 30'; required the angle A, opposite to BC.

2. *Geometrically*: Draw the line AC, and at any point of it, suppose C, make the angle C=56° 30'; then take CB=84, and with the length of 156=AB taken in your compasses from the same scale of equal parts, fixing one point in B, with the other crosses AC in A. Lastly, join A and B; so the triangle is constructed, and the required angle A may be measured by a line of chords.

2. *By calculation*: We have, by theor. 1. the following proportion for finding the angle A, *viz.*

$$A B : B C :: S, C : S, A.$$

<i>i. e.</i> as AB	156	2.19312
To BC	84	1.92428
So is S, C	56° 30'	9.92111
To S, A	26° 41'	9.65227

CASE II. The angles, and a side opposite to one of them, being given, to find a side opposite to another.

EXAMPLE. In the triangle HBG (*ibid.* n<sup>o</sup> 5.) suppose the angle H 46° 15', and the angle B 54° 22', consequently the angle G 79° 23', and the leg HB 125, required HG.

*Geometrically*: Draw HB 125, from any line of equal parts, and make the angle H 46° 15', and B 54° 22', then produce the lines HG and BG till they meet one another in the point G: so the triangle is constructed, and HG is measured by taking its length in your compasses, and applying it to the same line of equal parts that HB was taken from.

2. *By calculation*: By the first of the preceding theorems, we have this analogy for finding HG. *viz.*

$$S, G : H B :: S, B : H G.$$

<i>i. e.</i> As the sine of G	79° 23'	9.99250
is to the leg HB	125	2.09691
so is the sine of B	54° 22'	9.90996
to the leg HG	103 4	2.01437

CASE III. Two sides and an angle opposite to one of them given, to find the third side.

EXAMPLE. In the triangle KLM (*ibid.* n<sup>o</sup> 6.) suppose the side CL 126 equal parts, and KM 130 of these parts, and the angle L (opposite to KM) 63° 20', required the side ML.

1. *Geometrically*: The construction of this case is the same with that in Case I. (there being the same things given in both,) and the leg ML may be measured by applying it to the same line of equal parts that the other two were taken from.

2. *By calculation*: The solution of this case depends upon the two preceding ones; and, first, we must find the other two angles by Case I. thus:

$$M K : S, L :: K L : S, M.$$

<i>i. e.</i> As the side MK	130	2.11394
To the sine of L	63° 20'	9.95116
So is the side KL	126	2.10037
To the sine of M	60° 1'	9.93759

Then by Case II. we have the required leg ML, thus:

$$S, L : S, K :: M K : M L.$$

<i>i. e.</i> As the sine of L	63° 20'	9.95116
To the sine of K	53° 39'	9.90602

So is KM	130	2.11394
To ML	117.2	2.06850

CASE IV. Two sides and the contained angle being given, to find the other two angles.

EXAMPLE: In the triangle ACD (*ibid.* n<sup>o</sup> 7.) suppose AC=103, AD=126, and the angle A=54° 30'; required the angles C and D.

1. *Geometrically*: Draw AD=126, and make the angle A=54° 30'; then set off 103 equal parts from A to C: lastly, join C and D; and so the triangle is constructed, and the angles C and D may be measured by a line of chords.

2. *By calculation*: The solution of this case depends upon the second and third of the preceding theorems; and first we must find the sum and difference of the sides, and half the sum of the unknown angles, thus:

The leg AD s	126
The leg AC is	103

Their sum is	229
And their difference is	23
The sum of the three angles A, D, and C, is	180°
The angle A is	54° 30'

So the sum of the angles C and D will be 125° 30'

And half their sum is 62° 45'

Then by theor. 2. we have the following proportion, *viz.*

As the sum of the sides AD and AC=229

To their difference 23

So is the tangent of half the sum of the unknown angles C and D } 62° 45' 10.28816

To tang. of half their difference 11° 2' 9.29005

Now having half the sum and half the difference of the two unknown angles C and D, we find the quantity of each of them by theorem 3. thus:

To half the sum of the angles C and D, *viz.* 62° 45'

Add half their difference, *viz.* 11° 02'

And the sum is the greater angle C 73° 47'

Again from half their sum, *viz.* 62° 45'

Take half their difference, *viz.* 11° 02'

And there will remain the lesser angle D = 51° 43'

N B. The greater angle is always that subtended by the greater side: thus, in the present case, the greater angle C, is subtended by the greater side AD; and the lesser angle D is subtended by the lesser side AC.

CASE V. Two sides and the contained angle being given, to find the third side.

EXAMPLE. In the triangle BCD (*ibid.* n<sup>o</sup> 8.) suppose BC=154, BD=133, and the angle B=56° 03'; required the side CD

1. *Geometrically*: The construction of this case is the same with that of the last, and the length of DC is found by taking its length in your compasses, and applying it to the same line of equal parts that the two legs were taken from.

2. *By calculation*: The solution of this case depends upon the second and fourth; and first we must find the angles by the last case; thus:

As the sum of the sides BD and BC 287

2.45788

Is to their difference 21 1.32222  
 So is the tangent of half the sum of } 61° 58' 10.27372  
 the angles D and C }  
 To the tangent of half their difference 7° 50' 9.13806  
 So by theorem 3. we have the angles D and C thus :  
 To half the sum of the angles D and C 61° 58'  
 Add half their difference 7° 50'

And the sum is the greater angle D 69° 48'  
 Also, from half the sum 61° 58'  
 Take half the difference 7° 50'

And there remains the lesser angle C 54° 08'  
 Then by Case II. we have the following analogy for finding DC the leg required, viz.

$$S. C : B D :: S. B : D C.$$

i. e. As the sine of C 54° 08' 9.90869  
 To BD 133 2.12385  
 So is the sine of B 56° 03' 9.91883  
 To DC 136.2 2.13399

CASE VI. Three sides being given, to find the angles.  
 EXAMPLE: In the triangle A B C (*ibid* n° 9.) suppose AB=156, AC=185.7, and BC=84; required the angles A, B, and C.

I. *Geometrically*: Make AC=185.7 from any line of equal parts; and from the same line taking 156=AB in your compasses, fix one foot of them in A, and with another sweep an arch; then take 84=BC in your compasses, and fixing one foot in C, with the other sweep an arch, which will cross the former in B: lastly, join the points B and A, and B and C; so the triangle will be constructed, and the angles may be measured by a line of chords.

II. *By calculation*: Let fall the perpendicular, BD, from the vertex B, upon the base AC; which will divide the base into two segments AD and DC, the lengths whereof may be found by theorem 4. thus:

As the base AC 185.7 2.26893  
 To the sum of the sides AB and BC 240 2.38031  
 So is the difference of the sides 72 1.85733

To the diff. of the segments of the base 93 1.96871  
 And having the sum of the segments viz. the whole base, and their difference, we find the segments themselves, by theorem 3. thus:

To half the sum of the segments 92.8  
 And half their difference 46.5

And the sum is the greater segment AD 139.3  
 Also from half the sum of the segment 92.8  
 Take half their difference 46.5

The remainder is the lesser segment DC 46.3

Now the triangle ABC is divided, by the perpendicular DB, into two right-angled triangles, ADB and DBC; in the first of which are given the hypotenuse AB=156, and the base AD=139.3, to find the oblique angles, for which we have (by Case V. of rectangular trigonometry) the following analogy, viz.

As AB 156 2.19312  
 To AD 139.3 2.14395  
 So is the radius 90° 10.00000

To the co-sine of the angle A 26° 40' 9.95083

Also the angle C is found by the same case, thus:  
 As BC 84 1.92428  
 To CD 46.3 1.66558  
 So is the radius 90° 10.00000

To the co-sine of C 56° 30' 9.74130  
 Having found the two angles A and C, we have the third, B, by taking the sum of the other two from 180, thus:  
 The sum of all the three angles is 180°  
 The sum of A and C is 83° 10'

The angle B is 96° 50'  
 All the proportions used for the solutions of the several cases in plain trigonometry, may be performed by the scale and compass. On the scale there are several logarithmic lines, viz. one of numbers, another of sines, and one of tangents, &c.

And the way of working a proportion by these is this, viz. extend your compasses from the first term of your proportion, found on the scale, to the second; and with that extent, fixing one foot in the third term, the other will reach the fourth term required.

### SPHERICAL TRIGONOMETRY.

SPHERICAL TRIGONOMETRY is the art whereby, from three given parts of a spherical triangle, we discover the rest; and, like plane trigonometry, is either right-angled, or oblique-angled. But before we give the analogies for the solution of the several cases in either, it will be proper to premise the following theorems.

THEOREM I. In all right-angled spherical triangles, the sine of the hypotenuse: radius :: sine of a leg: sine of its opposite angle. And the sine of a leg: radius :: tangent of the other leg: tangent of its opposite angle.

DEMONSTRATION. Let E D A F G (*ibid*. fig. 3.) represent the eighth part of a sphere, where the quadrantal planes E D F G, E D B C, are both perpendicular to the quadrantal plane A D F B; and the quadrantal plane A D G C is perpendicular to the plane E D F G; and the spherical triangle A B C is right-angled at B, where CA is the hypotenuse, and BA, BC, are the legs.

To the arches G F, C B, draw the tangents H F, O B, and the sines G M C I on the radii D F D B; also draw B L the sine of the arch A B, and C K the sine of A C; and then join I K and O L. Now H F, O B, G M, C I, are all perpendicular to the plane A D F B. And H D, G K, O L, lie all in the same plane A D G C. Also F D, I K, B L, lie all in the same plane A D G C. Therefore, the right-angled triangles H F D, C I K, O L B, having the equal angles H D F, C K I, O L B, are similar. And C K : D G :: C I : G M; that is, as the sine of the hypotenuse: rad. :: sine of a leg: sine of its opposite angle. For G M is the sine of the arc G F, which measures the angle C A B. Also, L B : D F :: B O : F H; that is, as the sine of a leg: radius :: tangent of the other leg: tangent of its opposite angle, Q. E. D.

Hence it follows, that the sines of the angles of any oblique spherical triangle A C D (*ibid*. n° 2.) are to one another, directly, as the sines of the opposite sides. Hence it also follows, that, in right-angled spherical triangles, having the same perpendicular, the sines of the bases will be to each other, inversely, as the tangents of the angles at the bases.

THEOREM

**THEOREM II.** In any right-angled spherical triangle ABC (*ibid.* n° 3.) it will be, As radius is to the co sine of one leg, so is the co sine of the other leg to the co-sine of the hypothenuse.

Hence, if two right-angled spherical triangles ABC, CBD (*ibid.* n° 2) have the same perpendicular BC, the co-sines of their hypothenuses will be to each other, directly, as the co-sines of their bases.

**THEOREM III.** In any spherical triangle it will be, As radius is to the sine of either angle, so is the co-sine of the adjacent leg to the co-sine of the opposite angle.

Hence, in right-angled spherical triangles, having the same perpendicular, the co-sines of the angles at the base will be to each other, directly, as the sines of the vertical angles.

**THEOREM IV.** In any right-angled spherical triangle it will be, As radius is to the co-sine of the hypothenuse so is the tangent of either angle to the co-tangent of the other angle.

As the sum of the sines of two unequal arches is to their difference, so is the tangent of half the sum of those arches to the tangent of half their difference: and, as the sum of the co-sines is to their difference, so is the co-tangent of half the sum of the arches to the tangent of half the difference of the same arches.

**THEOREM V.** In any spherical triangle ABC (*ibid.* n° 4 and 5.) It will be, as the co-tangent of half the sum of half their difference, so is the co-tangent of half the base to the tangent of the distance (DE) of the perpendicular from the middle of the base.

Since the last proportion, by permutation, becomes co-tang.  $\frac{AC+BC}{2}$  : co-tang. AE :: tang.  $\frac{AC-BC}{2}$  : tang.

DE, and as the tangents of any two arches are, inversely, as their co-tangents; it follows, therefore, that tang. AE :

tang.  $\frac{AC+BC}{2}$  :: tang.  $\frac{AC-BC}{2}$  : tang. DE, or, that

the tangent of half the base is to the tangent of half the sum of the sides, as the tangent of half the difference of the sides to the tangent of the distance of the perpendicular from the middle of the base.

**THEOREM VI.** In any spherical triangle ABC (*ibid.* n° 4) it will be, as the co tangent of half the sum of the angles at the base, is to the tangent of half their difference, so is the tangent of half the vertical angle to the tangent of the angle which the perpendicular CD makes with the line CF bisecting the vertical angle.

The Solution of the Cases of right-angled spherical Triangles, (*ibid.* n° 3.)

Case	Given	Sought	Solution
1	The hyp. AC and one angle A	The opposite leg BC	As radius : sine hyp. AC :: sine A : sine BC (by the former part of theor. 1.)
2	The hyp. AC and one angle A	The adjacent leg AB	As radius : co-sine of A :: tang. AC : tang. AB by the latter part of theo. 1.
3	The hyp. AC and one angle A	The other angle C	As radius : co-sine of AC :: tang. A : co-tang. C (by theorem 4.)
4	The hyp. AC and one leg AB	The other leg BC	As co sine AB : radius :: co-sine AC : co-sine BC (by theorem 2.)
5	The hyp. AC and one leg AB	The opposite angle C	As sine AC : radius :: sine AB : sine C (by the former part of theorem 1.)
6	The hyp. AC and one leg AB	The adjacent angle A	As tang. AC : tang. AB :: radius : co-sine A (by theorem 1.)
7	One leg AB and the adjacent angle A	The other leg BC	As radius : sine AB :: tangent A : tangent BC (by theorem 4.)
8	One leg AB and the adjacent angle A	The opposite angle C	As radius : sine A :: co-sine of AB : co-sine of C (by theorem 3.)
9	One leg AB and the adjacent angle A	The hyp. AC	As co sine of A : radius :: tang. AB : tang. AC (by theorem 1.)
10	One leg BC and the opposite angle A	The other leg AB	As tang. A : tang. BC :: radius : sine AB (by theorem 4.)
11	One leg BC and the opposite angle A	The adjacent angle C	As co-sine BC : radius :: co-sine of A : sine C (by theorem 3.)
12	One leg BC and the opposite angle A	The hyp. AC	As sine A : sine BC :: radius : sine AC (by theorem 1.)
13	Both legs AB and BC	The hyp. AC	As radius : co-sine AB :: co-sine BC : co sine AC (by theorem 2.)
14	Both legs AB and BC	An angle, suppose A	As sine AB : radius :: tang. BC : tang. A (by theorem 4.)
15	Both angles A and C	A leg, suppose AB	As sine A : co-sine C :: radius : co-sine AB (by theorem 3.)
16	Both angles A and C	The hyp. AC	As tan. A : co-tang. C :: radius : co-sine AC (by theorem 4.)

Note, The 10th, 11th, and 12th cases are ambiguous; since it cannot be determined by the data, whether A, B, C, and AC, be greater or less than 90 degrees each.

The

The Solution of the Cases of oblique spherical Triangles, (*ibid.* n° 4. and 5.)

Case	Given	Sought	Solution
1	Two sides AC, BC, and an angle A opposite to one of them.	The angle B opposite to the other	As sine BC : sine A :: sine AC : sine B (by theor. 1.) Note, this case is ambiguous when BC is less than AC; since it cannot be determined from the data whether B be acute or obtuse.
2	Two sides AC, BC, and an angle A opposite to one of them.	The included angle ACB	Upon AB produced (if need be) let fall the perpendicular CD : then (by theor. 4.) rad. : co-sine AC :: tang. A : co-tang. ACD, but (by theor. 1.) as tang. BC : tang. AC :: co-sine ACD : co-sine BCD. Whence $ACB = ACD \pm BCD$ is known.
3	Two sides AC, BC, and an angle opposite to one of them	The other side AB	As rad. : co-sine A :: tang. AC : tang. AD (by theor. 1.) and (by theor. 2.) as co-sine AC : co-sine BC :: co-sine AD : co-sine BD. Note, this and the last case are both ambiguous when the first is so.
4	Two sides AC, AB, and the included angle A	The other side BC	As rad. : co-sine A :: tang. AC : tan. AB (by theor. 1.) whence AD is also known : then (by theor. 2.) as co-sine AD : co-sine BD :: co-sine AC : co-sine BC.
5	Two sides AC, AB, and the included angle A	Either of the other angles, suppose B	As rad. : co-sine A :: tang. AC : tan. AD (by theorem 1.) whence BD is known : then (by theor. 4.) is sine BD : sine AD :: tan. A : tan. B.
6	Two angles A, ACB, and the side AC betwixt them	The other angle B	As rad. : co-sine AB :: tang. A : co-tang. ACD (by theor. 4.) whence BCD is also known : then (by theor. 3.) as sine ACD : sine BCD :: co-sine A : co-sine B.
7	Two angles A, ACB, and the side AC betwixt them	Either of the other sides suppose BC	As rad. : co-sine AC :: tang. A : co-tang. ACD (by theo. 4.) whence BCD is also known : then, as co-sine BCD : co-sine ACD :: tang. AC : tang. BC (by theor. 1.)
8	Two angles A, B, and a side AC opposite to one of them	The side BC opposite the other	As sine B : sine AC :: sine A : sine BC (by theorem 1.)
9	Two angles A, B, and a side AC opposite to one of them	The side AB betwixt them	As rad. : co-sine A :: tang. AC : tan. AD (by theor. 1.) and as : tang. B : tang. A :: sine AD : sine BD (by theor. 4.) whence AB is also known.
10	Two angles A, B, and a side AC opposite to one of them	The other angle ACB	As rad. : co-sine AC :: tang. A : co-tang. ACD (by theor. 4.) and as co-sine A : co-sine B :: sine ACD : sine BCD (by theor. 3.) whence ACB is also known.

Cafe	Given	Sought	Solution
11	All the three sides AB, AC, and BC	An angle, sup- pose A	$\text{As tang. } \frac{1}{2} AB : \text{tang. } \frac{AC+BC}{2} :$ $\text{tang. } \frac{AC-BC}{2} : \text{tang. DE, the dif-}$ <p>tance of the perpendicular from the middle of the base (by theor. 6.) whence AD is known: then, as tang-AC : tang. AD :: rad. : co-sine A (by theorem 1.)</p>
12	All the three angles A, B, and ACB	A side, suppose AC	$\text{As co-tan. } \frac{ABC+A}{2} : \text{tan. } \frac{ABC-A}{2}$ $: : \text{tang. } \frac{ACB}{2} : \text{tang. of the angle in-}$ <p>cluded by the perpendicular and a line bisecting the vertical angles; whence ACD is also known: then (by theor. 5.) tang. A : co-tang. ACD :: rad. : oc-sine AC.</p>

## T R I

TRINGA, in ornithology, a genus of birds belonging to the order of grallæ. The beak is somewhat cylindrical, and as long as the head; the nostrils are linear; and there are four toes on the feet, the hind one consisting of one joint, and elevated above the ground. There are 23 species, principally distinguished by their colour.

TRINGLE, in architecture, a name common to several little square members or ornaments, as reglets; listels, and plat-bands. It is more particularly used for a little member fixed exactly over every triglyph, under the plat-band of the architrave, from whence the guttæ or pendant drops hang down.

TRINIDAD, or TRINITY-ISLAND, is situated in the Atlantic or American ocean, between  $60^{\circ}$  and  $62^{\circ}$  of west longitude, and between  $9^{\circ}$  and  $11^{\circ}$  of north latitude; it is about ninety miles long, and sixty broad.

TRINIDAD, a port-town of Mexico, in America, situated in the province of Guatimala, an hundred and twenty miles south-east of the city of Guatimala: W. long.  $94^{\circ}$ , N. lat.  $13^{\circ}$ .

TRINITARIANS, those who believe in the Trinity; those who do not believe therein, being called antitrinitarians.

Trinitarians also denote an order of religious instituted at Rome in the year 1198, under the pontificate of Innocent III. the founders whereof were John de Matha, and Felix de Valois. His holiness gave them permission to establish this order for the deliverance of captives, who groaned under the tyranny of the infidels: he gave them, as a habit, a white gown ornamented with a red and blue cross. After the death of the two founders, pope Honorius III. continued the order, and their rule was approved by his successor Clement IV. in 1267. At first they were not permitted to eat flesh, and, when they travelled, were to ride only upon asses. But their rule was corrected and mitigated by the bishop of Paris, and the abbots of St. Victor and St. Genevieve, who allowed them to eat any kind of food, and to use horses. This

## T R I

order possesses about two hundred and fifty convents in thirteen different provinces: six of which are in France; namely, France, Normandy, Picardy, Champagne, Languedoc, and Provence; three in Spain, viz. New Castile, Old Castile, and Arragon; one is in Italy, and one in Portugal. There was formerly the province of England, where this order had forty-three houses; that of Scotland, where it had nine; and that of Ireland, where it had fifty-two; besides a great number of monasteries in Saxony, Hungary, Bohemia, and other countries. The convent of Cersfroy in France is head of the order.

TRINITY, in theology, the ineffable mystery of three persons in one God; Father, Son, and Holy Spirit.

TRINITY SUNDAY, a festival observed on the Sunday next after Whitsunday, in honour of the holy Trinity. The observation of this festival was first enjoined in the council of Arles, anno 1260.

Fraternity of the TRINITY, a religious society instituted at Rome by St. Philip Neri, in 1548. These religious were appointed to take care of the pilgrims who came to visit the tombs of St. Peter and St. Paul. The society originally consisted of only fifteen religious, who assembled on the first Sunday of every month, in the church of St. Saviour del Campo, to hear the exhortations of the founder; after whose death pope Paul IV. gave the fraternity the church of St. Benedict, near which they have since built a large hospital, for the reception of pilgrims. The fraternity is one of the most considerable in Rome, and most of the nobility of both sexes have been members thereof.

TRIO in music, a part of a concert wherein three persons sing; or more properly a musical composition consisting of three parts.

TRIONES, in astronomy, a sort of constellation or assemblage of several stars in the urse minor, commonly called Charles's wain.

TRIOPTERIS; in botany, a genus of the decandria trigynia

Fig. 1. Rectangular TRIGONOMETRY

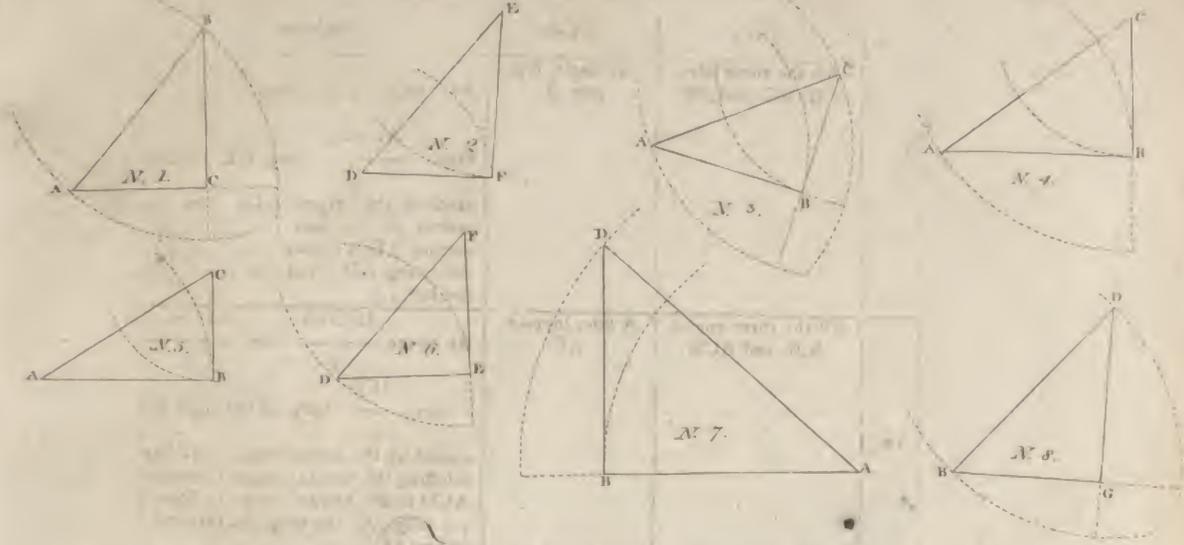


Fig. 2. Oblique angled TRIGONOMETRY

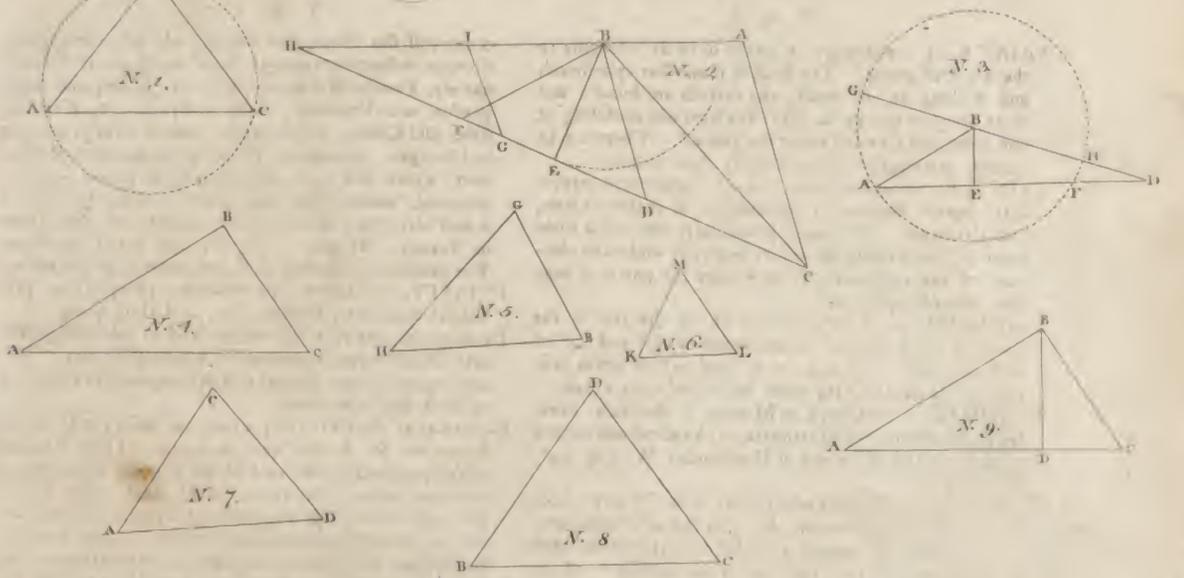
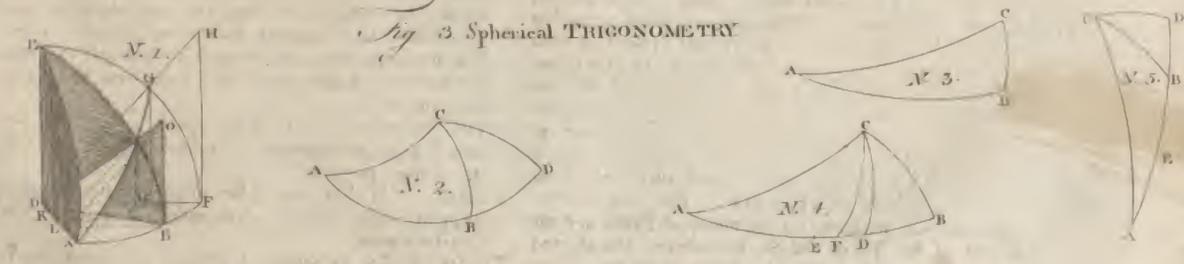


Fig. 3. Spherical TRIGONOMETRY





- gynia* class. The calix consists of six segments; and there are three seeds, with a double membranous wing. There is but one species, a native of Jamaica.
- TRIP**, a sea-term. A ship is said to bear her top-sails a-trip, when she carries them hoisted up to the highest.
- TRIPARTITE**, something divided into three parts, or made by three parties, as indented tripartite, &c.
- TRIPARTITION**, a division by three, or the taking the third part of any number or quantity.
- TRIPHTHONG**, in grammar, an assemblage or concurrence of three vowels in the same syllable, as *que*.
- TRIPLE**, in music, is one of the species of measure or time. See **MUSIC**.
- TRIPOD**, in antiquity, a famed sacred seat or stool, supported by three feet, whereon the priests and sibyls were placed to render oracles. It was on the tripod that the gods were said to inspire the Pythians with that divine fury and enthusiasm wherewith they were seized at the delivery of their predictions.
- TRIPOLI**, a state of Africa, which including Barca, is bounded by the Mediterranean-sea on the north, by Egypt on the east, by Nubia and Bildulgerid on the south, and by Tunis on the west; extending along the shore of the Mediterranean from the north-west to the south-east about a thousand miles, but scarce two hundred miles broad in any place. The city of Tripoli, being the capital of this state, is surrounded with a wall and other fortifications: E. long.  $14^{\circ} 30'$ , N. lat.  $33^{\circ} 30'$ .
- TRIQUETROUS**, among botanists, expresses a fruit or leaf that has three sides or faces all flat.
- TRIREMIS**, in antiquity, a gally with three ranks of oars on a side.
- TRISMEGISTUS**, an epithet or surname given to one of the two Hermes, or Mercuries, kings of Thebes in Egypt, who is said to be contemporary with Moses.
- TRISPASTON**, in mechanics, a machine with three pulleys, or an assemblage of three pulleys for raising of great weights.
- TRISYLLABLE**, in grammar, a word consisting of three syllables.
- TRITICUM**, in botany, a genus of the triandria digynia class. The calix consists of two scissile valves, containing three flowers. There are eleven species, only three of them natives of Britain, *viz.* the repens, or couch-grass; the caninum, or bearded wheat-grass; and the junceum, or sea wheat-grass. For the culture of wheat, see **AGRICULTURE**, p. 60.
- TRITON**, in zoology, a genus belonging to the order of vermes mollusca. The body is oblong; the tongue is spiral; it has 12 tentacula, six on each side, the hindmost ones having claws like a crab. There is but one species, found in holes of rocks about the sea-shore.
- TRITON**, a sea demi-god, held by the ancients to be an officer or trumpeter of Neptune, attending on him, and carrying his orders and commands from sea to sea.
- TRITURATION**, the act of reducing a solid body into a subtile powder; called also levigation and pulverization.
- TRIOFFETTA**, in botany, a genus of the dodecandria monogynia class. The corolla consists of five petals, and the calix of five leaves; and the capsule is hairy, and opens in four parts. There are two species, both natives of India.
- TRIUMPH**, in Roman antiquity, a public and solemn ho-

nor conferred by the Romans on a victorious general; by allowing him a magnificent entry into the city.

The greater triumph, called also curulis, or simply the triumph, was decreed by the senate to a general, upon the conquering of a province, or gaining a signal victory. The day appointed for the ceremony being arrived, scaffolds were erected in the forum and circus, and all the other parts of the city, where they could best behold the pomp: the senate went to meet the conqueror without the gate called Capena or Triumphalis, and marched back in order to the capitol; the ways being cleared and cleaned by a number of officers and tiptiffs, who drove away such as thronged the passage, or straggled up and down. The general was clad in a rich purple robe, interwoven with figures of gold, setting forth his great exploits; his buskins were beset with pearl; and he wore a crown, which at first was only laurel, but afterwards gold; in one hand he bore a branch of laurel, and in the other a truncheon. He was drawn in a magnificent chariot, adorned with ivory and plates of gold, drawn usually by two white horses; though sometimes by other animals, as that of Pompey, when he triumphed over Africa, by elephants; that of Marc Antony, by lions; that of Hellogabalus, by tygers; that of Aurelian, by deer, &c. His children were at his feet, and sometimes on the chariot-horses. The procession was led up by the musicians, who played triumphal pieces, in praise of the general: these were followed by young men, who led the victims to the sacrifice, with their horns gilded, and their heads adorned with ribbands and garlands; next came the carts and waggons, loaded with all the spoils taken from the enemy, with their horses, chariots, &c. these were followed by the kings, princes, and generals, who had been taken captives, loaden with chains: after these appeared the triumphal chariot, before which, as it passed, they all along strewed flowers, and the people, with loud acclamations, called out *Io triumphe!* The chariot was followed by the senate, clad in white robes; and the senate by such citizens as had been set at liberty or ransomed: and the procession was closed by the priests and their officers and utensils, with a white ox led along, for the chief victim. In this order they proceeded through the triumphal gate, along the via sacra, to the capitol, where the victims were slain. In the mean time all the temples were open, and all the altars loaded with offerings and incense; games and combats were celebrated in the public places, and rejoicings appeared every where.

**TRIVIR**, one of three persons who govern absolutely, and with equal authority, in a state. It is chiefly applied to the Roman government: Cæsar, Pompey, and Crassus were the first triumvirs, who divided the government amongst them. There were also other officers, called triumvirs; as the triumviri or tresviri capitales, who were the keepers of the public goal: they had the office of punishing malefactors; for which purpose they kept eight lieters under them.

**TRIVIRATE**, an absolute government, administered by three persons with equal authority. See the preceding article.

**TROCHANTER**, in anatomy. See **ANATOMY**, p. 187.

**TROCHE**, in pharmacy, a sort of medicine, made of glutinous substances, into little cakes, and afterwards excocated.

- TROCHÆUS**, in the Greek and Latin poetry, a foot consisting of two syllables, the first long, and the second short.
- TROCHILUS**, in ornithology, a genus belonging to the order of picæ. The beak is subulated and thread-shaped, with a tubular apex, and longer than the head, the superior mandible sheathing the inferior; the tongue is thread-shaped; and the feet are fitted for walking. This genus comprehends all the humming birds, which are the smallest of birds, and are distinguished by their colour and the shape of their bills.
- TROCHLEA**, one of the mechanical powers, usually called a pulley. See **MECHANICS**.
- TROCHLEARES**, in anatomy. See **ANATOMY**, p. 290.
- TROGLODYTES**, in the ancient geography, a people of Æthiopia, said to have lived in caves under ground. Pom. Mela gives a strange account of the Troglodytes: he says, they did not so properly speak as shriek, and that they lived on serpents.
- TROJA**, or **TROJAN GAMES**, were games said to be instituted by Ascanius, son of Æneas, and afterwards kept up by the Romans with great solemnity. They were celebrated by companies of boys, neatly dressed, and furnished with little arms and weapons, who mustered in the public circus. They were chosen, for the most part, out of the noblest families of Rome, and the captain of them had the honourable title of princeps juventutis, being sometimes next heir to the empire, and seldom less than the son of a principal senator.
- TROIS RIVIERES**, a town of North America, in the province of Canada, situated on the river of St. Laurence, fifty miles south of Quebec: W. long. 75°, and N. lat. 46° 45'.
- TRONAGE**, an ancient customary toll, paid for weighing of wool. This word is particularly mentioned in a charter granted to the mayor and citizens of London; in which city there is an officer called tronator, whose business it is to weigh the wool that is brought thither.
- TRONCONNÉE**, in heraldry, denotes a cross, or other thing, cut in pieces and dismembered, yet so as all the pieces keep up the form of a cross, though set at a small distance from one another.
- TROOP**, a small body of horse or dragoons, about fifty or sixty, sometimes more, sometimes less; commanded by a captain. Each troop, besides a captain, has a lieutenant, cornet, quarter-master, and three corporals, who are the lowest officers of a troop.
- TROPÆOLUM**, in botany, a genus of the octandria monogynia class. The calix consists of one calcarated leaf; and the corolla of five unequal petals; and there are three dry berries. The species are three, all natives of Peru.
- TROPE**, in rhetoric, a kind of figure of speech, whereby a word is removed from its first and natural signification, and applied with advantage to another thing, which it does not originally mean; but only stands for it, as it has a relation to or connection with it: as in this sentence, *God is my rock*. Here the trope lies in the word *rock*, which being firm and immoveable, excites in our minds the notion of God's unfailing power, and the steady support which good men receive from their dependence upon him.
- TROPHY**, among the ancients, a pile or heap of arms of a vanquished enemy, raised by the conqueror in the most eminent part of the field of battle.
- TROPICS**, in astronomy. See **ASTRONOMY**, p. 469.
- TROUT**, in ichthyology. See **SALMO**.
- TRUFFLES**. See **LYCOPERDON**.
- TRUMPET**, a musical instrument, the most noble of all portable ones of the wind kind, used chiefly in war among the cavalry, to direct them in the service.
- TRUNCATED**, in general, is an appellation given to such things as have, or seem to have, their points cut off: thus we say, a truncated cone, pyramid, leaf, &c.
- TRUNCHEON**, a short staff, or battoon, used by kings, generals, and great officers, as a mark of their command.
- TRUNDLE**, a sort of carriage with low wheels, whereon heavy and cumbersome burdens are drawn.
- TRUNK**, among botanists, denotes the stem, or body, of a tree; or, that part between the ground and the place where it divides into branches.
- TRUNNIONS**, or **TRUNIONS** of a piece of ordnance, are those knobs or bunches of the gun's metal, which bear her up on the cheeks of the carriage.
- TRUSS**, a bundle, or certain quantity of hay, straw, &c. A truss of hay is to contain fifty-six pounds, or half an hundred weight; thirty-six trusses make a load.
- TRUSS** is also used for a sort of bandage or ligature, made of steel, or the like matter, wherewith to keep up the parts in those who have hernias or ruptures.
- TRUSTEE**, one who has an estate, or money, put or trusted in his hands for the use of another.
- TRUTH**, a term used in opposition to falsehood, and applied to propositions which answer, or accord, to the nature and reality of the thing whereof something is affirmed or denied.
- TUB**, in commerce, denotes an indeterminate quantity or measure: thus, a tub of tea contains about sixty pounds; and a tub of camphor from fifty-six to eighty pounds.
- TUBE**, in general, pipe, conduit, or canal; a cylinder hollow within, either of lead, iron, wood, glass, or other matter, for the air, or some other fluid, to have a free passage or conveyance through.
- TUBERCLE**, in botany, a kind of round turgid root, in form of a knob or turnip.
- The plants which produce such roots are hence denominated tuberosæ, or tuberous, plants.
- TUBERCLES**, among physicians, denote little tumours which suppurate and discharge pus, and are often found in the lungs, especially of consumptive persons.
- TUBIPORA**, a genus of submarine plants, belonging to the cryptogamia class, of the hardness of coral, and consisting of cylindrical tubes rising from a thin crust of the same sort of matter with themselves.
- TUBULI LACTIFERI**, in anatomy. See **ANATOMY**, p. 277.
- TUCUMAN**, the south-west division of the province of La Plata, or Paraguay, in South America.
- TULIPA**, in botany, a genus of the hexandria monogynia class. The corolla is bell-shaped, and consists of six petals; it has no stylus. There are three species, none of them natives of Britain.
- TUMEFACCTION**, the act of swelling or rising into a tumour.
- TUMOUR**, in medicine and surgery, a preternatural rising

- rising or eminence on any part of the body. See SURGERY, p. 663.
- TUN**, a large vessel or cask of an oblong form, biggest in the middle, and diminishing towards its two ends, girt about with hoops, and used for stowing several kinds of merchandize, for convenience of carriage; as brandy, oil, sugar, skins, hats, &c. This word is also used for certain vessels of extraordinary bigness, serving to keep wine in for several years.
- TUN** is also a certain weight whereby the burden of ships, &c. are esteemed.
- TUNBRIDGE**, a town of Kent, situated thirty-three miles west of Canterbury, much resorted to on account of its excellent waters.
- TUNICA**, a kind of waistcoat, or under garment, in use amongst the Romans. They wore it within doors by itself, and abroad under the gown. The common people could not afford the toga, and so went in their tunics, whence Horace calls them *popellus tunicarus*.
- TUNICA**, in anatomy, is applied to the membranes which invest the vessels, and divers others of the less solid parts of the body; thus the intestines are formed of five tunics, or coats.
- TUNIS**, the capital of the kingdom of Tunis, thirty miles south of Carthage ruins, 300 miles east of Algiers, and 120 south-west of Trapano, in Sicily; a populous city, about three miles in circumference: E. long. 10° N. lat. 36° 20'. The kingdom of Tunis is situated on the coast of Barbary, in Africa, being bounded by the Mediterranean sea on the north. It extends 200 miles in length from east to west, along the shore of the Mediterranean; the breadth is very unequal.
- TUNNAGE** is used for a custom or impost, payable to the crown, for goods and merchandize imported or exported, and is to be paid after a certain rate for every tun thereof. This duty, as well as that of poundage, was first granted for life to king Charles II and has been continued in the same manner to his royal successors, down to his present majesty king George III.
- TURBAN**, the head-dress of most of the eastern nations. It consists of two parts, a cap, and a sash of fine linen or taffety, artfully wound in divers plaits about the cap. The cap has no brim, is pretty flat, though roundish at top, and quilted with cotton, but does not cover the ears. There is a good deal of art in giving the turban a fine air, and the making of them is a particular trade. The sash of the Turks turban is white linen; that of the Persians red woollen. These are the distinguishing marks of their different religions. Sophi, king of Persia, being of the sect of Ali, was the first who assumed the last colour, to distinguish himself from the Turks, who are of the sect of Omar, and whom the Persians esteem heretics.
- TURBINATED**, is a term applied by naturalists, to shells which are spiral, or wreathed, conically, from a larger basis to a kind of apex.
- TURBITH**, or **TURPETH-ROOT**, in the materia medica, the cortical part of the root of an Indian convolvulus, brought to us in oblong pieces, of a brown or ash-colour on the outside, and whitish within: the best is ponderous, not wrinkled, easy to break, and discovering a large quantity of resinous matter to the eye: its taste is at first sweetish; when chewed for a little time, it becomes acid,
- pungent, and nauseous. This root is a cathartic, not of the safest, or most certain kind.
- TURBITH-MINERAL**. See CHEMISTRY, p. 139.
- TURBO**, in zoology, a genus of insects belonging to the order of vermes testacea. This is an animal of the snail kind: the shell consists of one spiral solid valve; and the aperture is orbicular. There are 49 species, distinguished by peculiarities in their shells.
- TURBOT**, in ichthyology. See PLEURONECTES.
- TURCICA TERRA**, **TURKY-EARTH**, in the materia medica, a very fine bole or medicinal earth, dug in great plenty in the neighbourhood of Adrianople, and used by the Turks as a sudorific and astrigent, and famous among them in pestilential diseases.
- TURCOISE**, in natural history, an ore of copper.
- There are, indeed, two kinds of turcois; the one a true and genuine ore of copper; the other the bones of animals tinged to a beautiful blue colour, by having been buried in places where copper-ore has been near them.
- TURCOMANIA**, a province of Asiatic Turkey, bounded by Persia on the east, and answers to the ancient Armenia; its capital is Erzerum.
- TURDUS**, in ornithology, a genus belonging to the order of passeres. The bill is somewhat cylindrical and cultrated; the nostrils are naked; the faux is ciliated; and the tongue is lacerated. There are 28 species, principally distinguished by their colour.
- TURENNE**, a town of Guienne, in France: E. long. 1° 20', and N. lat. 45° 7'.
- TURGESCENCE**, among physicians, denotes a swelling, or growing bloated.
- TURIN**, the capital of Piedmont, in Italy, and of the king of Sardinia's dominions, is situated at the confluence of the rivers Po and Doria, 100 miles south-west of Milan: E. long. 7° 16', and N. lat. 44° 50'.
- TURIONES**, among herbalists, denotes the first young tender shoots which plants annually put forth.
- TURKEY**, in ornithology. See MELEAGRIS.
- TURKY**, a very extensive empire, comprehending some of the richest countries in Europe, Asia, and Africa.
- Turky in Europe, comprehends Romania, Bulgaria, Servia, Bosnia, Ragusa, Wallachia, Moldavia, Bessarabia, Budzac, Crim, and little Tartary, with Albania, Epirus, Macedonia, Thessaly, and all the ancient Greece, with its numerous islands. See ROMANIA, &c.
- Turky in Asia, comprehends Natolia, Diarbeck, Syria, Turcomania, and part of Georgia and Arabia.
- And Turkey in Africa, comprehends the fruitful and extensive country of Egypt.
- TURMERIC**, in the materia medica, the root of a plant, called by botanists curcuma. See CURCUMA.
- TURNEP**, in botany, a species of brassica. For the culture of them, see AGRICULTURE, p. 67.
- TURNERA**, in botany, a genus of the pentandria trigynia class. The calix is funnel-shaped, and consists of five segments; there are five petals inserted into the calix; the stigmata are divided into many parts; and the capsule has one cell. There are three species, none of them natives of Britain.
- TURNING**, a branch of sculpture, being the art of fashioning hard bodies, as brass, ivory, wood, &c. into a round or oval form, in a lathe.

**TURNSOLE**, in botany. See **CROTON**.

**TURPENTINE**, a transparent sort of resin, flowing either naturally or by incision from several unctuous and resinous trees, as the terebinthus, larch, pine, fir, &c.

The turpentine of Chio or Scio, which is the only genuine kind, and that which gives the denomination to all the rest, is a whitish resin, bordering a little on green, very clear, and a little odoriferous; drawn by incision from a tree called terebinthus, very common in that island, as also in Cyprus, and some parts of France and Spain.

The uses of turpentine in medicine are innumerable. It is a great vulnerary, and very detergent, and as such is prescribed in abscesses, ulcerations, &c. It promotes expectoration, and as such is prescribed in diseases of the lungs and breast; but it is most famous for clearing the urinary passages, and as such prescribed in obstructions of the reins, in gonorrhœas, &c.

*Oil of TURPENTINE.* There are two kinds of oil drawn from turpentine, by distillation; the first white, the second red, both esteemed as balsams proper for the cure of wounds, chilblains, &c. But they are so little used among us, that it is not easy to procure either of them.

What is commonly sold under the name of oil of turpentine, or ethereal oil, is only a distillation of the resinous juice of the tree, fresh as it is gathered. It is used with success in the cure of green wounds, as also by the painters, farriers, &c. To be good, it must be clear and pellucid as water, of a strong penetrating smell, and very inflammable.

**TURRITIS**, in botany, a genus of the tetradynamia filiquosa class. The pod is very long, and angular; the calix is connivent and erect; and the corolla is erect. There are two species, both natives of Britain, viz. the glabra, or great tower-mustard; and the hirsuta, or hairy tower-mustard.

**TURTLE**, in ichthyology. See **TESTUDO**.

**TUSCAN ORDER**, in architecture. See **ARCHITECTURE**, p. 351.

**TUSCAN EARTH**, in the materia medica, a yellowish, white, pure bole, considerably heavy, of a very smooth surface, not easily breaking between the fingers, but adhering slightly to the tongue, and melting very readily in the mouth. It is dug in many parts of Italy, particularly about Florence, where there is a stratum of it eight or ten feet thick, at the depth of five or six from the surface. It is given as a sudorific, and esteemed a great medicine in fevers, attended with diarrhœas.

**TUSCANY**, a duchy of Italy, encompassed by the pope's territories on the north-east and south, and bounded by the Tuscan Sea on the south-west, and by the territories of Lucca and Modena on the north-west, being 100 miles long, and almost as many broad.

**TUSSILAGO**, in botany, a genus of the syngenesia polygamia superflua classis. The receptacle is naked; the pappus is simple; the scales of the calix are equal, and somewhat membranaceous. There are nine species; three of them natives of Britain, viz. the farfara, or common colt's foot; the hybrida, or long-stalked butter-bur; and the petastita, or common butter bur.

The common colt's foot stands recommended in coughs and other disorders of the breast and lungs.

**TUTOR**. See **LAW**, Tit. vii. 1, &c.

**TUTTY**, a recement of mixed metals, in which lapis calaminaris, or zink in its metallic form, is an ingredient; collected in the furnaces where brass is made from copper and calamine, and where the mixed metals are run. In these furnaces they place, under the roof and about the upper parts of the sides, rods of iron, and sometimes rolls of dry earth, about which the tutty is afterwards found. Therefore the tutty which we use in the shops at this time, owes its origin truly and properly to zink, which sublimes with a very small fire into a kind of flowers, and, when fused with any other metal, flies from it in abundance under this form, and also frequently takes some part of the metal, more or less, up with it. Hence it is evident, that the tutty or cadmia of the ancients, must have been wholly different from ours, as they used no zink nor any of its ores in the furnace where they collected it.

Our tutty then is a hard and heavy semimetallic recement, sometimes met with in the shops in thin flat pieces or flakes, but most abundantly in tubular cylindrical pieces, resembling segments of the barks of trees pushed off from the branches without breaking; these are of different lengths and diameters. The finest tutty is that of a fine deep brown on the outside, and of a yellowish tinge within; the thickest, brightest, and most granulated; the hardest to break, and that which has least foulness among it.

Tutty is celebrated as an ophthalmic, and frequently employed as such in unguents and collyria.

**TUXFORD**, a market-town of Nottinghamshire, twenty miles north-east of Nottingham.

**TWEED**, a river of Scotland, which rises on the confines of the shire of Clydesdale, and running eastward through Tweedale, and dividing the shire of Mers from Tivjodale and Northumberland, falls into the German sea at Berwick.

**TWEEDALE**, a county of Scotland, bounded by Lothian on the north, by Mers and Tivjodale on the east, by Annandale on the south, and Clydesdale one the west.

**TWEER**, a city of Russia, capital of the province of Tweer, situated on the river Wolgo, ninety miles north of Moscow, in E. long. 30° 37', N. lat. 57° 25'.

**TWELFTH-DAY**, the festival of the epiphany, or the manifestation of Christ to the Gentiles; so called, as being the twelfth day, exclusive, from the nativity or Christmas-day.

**TWILIGHT**, that light, whether in the morning before sun-rise, or in the evening after sun-set, supposed to begin and end when the least stars that can be seen by the naked eye cease, or begin to appear. By means of the atmosphere it happens, that though none of the sun's direct rays can come to us after it is set, yet we still enjoy its reflected light for some time, and night approaches by degrees. For after the sun is hid from our eyes, the upper part of our atmosphere remains for some time exposed to its rays, and from thence the whole is illuminated by reflection.

**TWINS**, two young ones delivered at a birth; by an animal which ordinarily brings forth but one.

**TYGER**, or **TIGER**, in zoology. See **LEO**.

**TYLE**, or **TILE**, in building, a sort of thin laminated brick, used on the roofs of houses; or more properly a kind

kind of fat clayey earth, kneaded and moulded, of a just thickness, dried and burnt in a kiln like brick, and used in the covering and paving of houses.

**TYPAN** of an arch, is a triangular space or table in the corners or sides of an arch, usually hollowed, and enriched sometimes with branches of laurel, olive-tree, or oak, or with trophies, &c. sometimes with flying figures, as fame. &c. or sitting figures, as the cardinal virtues.

**TYPAN**, among printers, a double frame belonging to the press, covered with parchment, on which the blank sheets are laid in order to be printed off. See **PRINTING-PRESS**.

**TYPANUM**, in mechanics, a kind of wheel placed round an axis or cylindrical beam, on the top of which are two levers or fixed staves, for the more easy turning the axis, in order to raise a weight required. The tympanum is much the same with the peritrochium, but that the cylinder of the axis of the peritrochium is much shorter, and less than the cylinder of the tympanum.

**TYPANUM**, in anatomy. See **ANATOMY**, p. 296.

**TYPANY**, in medicine. See **MEDICINE**, p. 110.

**TYPE**, a copy, image, or resemblance of some model.

The word is much used among divines, to signify a symbol, sign, or figure of something to come; in which sense it is commonly used with relation to antitype, which is the thing itself, whereof the other is a type or figure.

**TYPE**, among letter-founders and printers, the same with letter. See **LETTER**.

**TYPE** is also used to denote the order observed in the intensification and remission of fevers, pulses, &c.

**TYPHA**, in botany, a genus of the monoecia triandria class. The amentum of both male and female is cylindrical; the calix of the male consists of three leaves; and neither of them have any corolla. There are two species, both of them natives of Britain, *viz.* the latifolia, or great cat's-tail; and angustifolia, or narrow-leaved cat's-tail.

**TYPHODES**, in medicine, a kind of ardent or burning fever usually attending on erysipelas of any of the viscera.

**TYPOGRAPHY**, the art of printing. See **PRINTING**.

**TYRANT**, among the ancients, denoted simply a king or monarch. But the ill use several persons invested with that sacred character made of it, has altered the import of the word; and tyrant now carries with it the idea of an unjust and cruel prince, who invades the peoples liberty, and rules in a more despotic manner than the laws of nature or the country do allow of.

**TYRE**, a port-town of Phœnicia, in Asiatic Turkey, situated on the coast of the Levant, in E. long. 36°, N. lat. 32° 32', being anciently the capital of Phœnicia.

**TYRONE**, an Irish county, in the province of Ulster; bounded by Londonderry, on the north; by Armagh and Lough-neah, on the east; by Monaghan and Fermanagh, on the south; and by Donnegal on the west.



## U, V.

### V A I

**VACCINIUM**, in botany, a genus of the octandria monogynia class. The calix is above the fruit; the corolla consists of one petal; the filaments are inserted into the receptacle; and the berry has four cells, containing many seeds. There are twelve species, five of them natives of Britain, *viz.* the myrtillus, or black whortleberries or bilberries; the uliginosum, or great bilberry-bush; the cantabricum, or Irish whorts; the vitis idea, or red whorts; and the oxycoccus, or craw-berries.

**VACUUM**, in philosophy, denotes a space empty or devoid of all matter or body.

**VAGINA**, properly signifies a sheath, or scabbard: and the term vagina is used, in architecture, for the part of a terminus, because resembling a sheath, out of which the statue seems to issue.

**VAGINA**, in anatomy, a large canal, formed of a robust or strong membrane, and reaching from the external orifice, or os pudendi, in women, to the uterus. See **ANATOMY**.

**VAGUM**, or **PAR VAGUM**. See **ANATOMY**, 249.

**VAIR**, in heraldry, a kind of fur, consisting of divers little pieces, argent, and azure, resembling a dutch U, or a bell glass. See **Plate CXLVII.** fig. 21.

**VAIRY**, in heraldry, expresses a coat, or the bearings of a coat, when charged or chequered with vairs: and hence,

### V A L

**vairy-cuppy**, or **vairy-tassy**, is a bearing composed of pieces representing the tops of crutches. See **Plate CXLVII.** fig. 22.

**VALAIS**, a territory of Switzerland, being a long valley of an hundred miles extent, lying between the head of the river Rhone and the lake of Geneva.

**VALANTIA**, in botany, a genus of the polygamia monoecia class. Neither the hermaphrodite or male have any calix; the corolla of each consists of four segments; there are four stamina; the stylus of the hermaphrodite is bifid, and it has but one seed. There are three species, only one of them, *viz.* the cruciata or cross-wort, a native of Britain.

**VALENCIA**, the capital of a province of the same name, in Spain, situated in a fine plain on the river Guadalaviar: W. long 35°, N. lat. 39° 20'.

**VALENTINIANS**, in church-history, a sect of Christian heretics, who sprung up in the 11d century, and were so called from their leader Valentinus.

The Valentinians were only a branch of the Gnostics, who realized or personified the platonic ideas concerning the deity, whom they called Pleroma, or plenitude. Their system was this: the first principle is Bythos, *i. e.* depth, which remained many ages unknown, having with

- it Ennoe or thought, and Sige or silence; from these sprung the Nous, or intelligence, which is the only son, equal to, and alone capable of comprehending, the Bythos; the sister of Nous they called Alethia, or truth; and these constituted the first quaternity of æons, which were the source and original of all the rest: for Nous and Alethia produced the world and life; and from these two proceeded man and the church. But besides these eight principal æons, there were twenty two more; the last of which, called Sophia, being desirous to arrive at the knowledge of Bythos, gave herself a great deal of ungasiness, which created in her Anger and Fear, of which was born Matter. But the Horos, or bounder, stopped her, preserved her in the pleroma, and restored her to her perfection. Sophia then produced the Christ and the Holy Spirit, which brought the æons to their last perfection, and made every one of them contribute their utmost to form the Saviour. Here Enthymese, or thought, dwelling near, the Pleroma, perfected by the Christ, produced every thing that is in the world, by its divers passions. The Christ sent into it the Saviour, accompanied with angels, who delivered it from its passions, without annihilating it: from thence was formed corporeal matter. And in this manner did they romance, concerning God, nature, and the mysteries of the Christian religion.
- VALERIANA**, in botany, a genus of the triandria monogynia class. It has no calix; the corolla consists of one petal, gibbous at the base, and situate above the fruit. There are 20 species, three of them natives of Europe, viz. the officinalis, or great wild valerian, whose root is alexipharmic, sedorific, and diuretic; the dioica, or marsh valerian; and the locusta, or lambs-lettuce.
- VALET**, a French term, used as a common name for all domestic men servants, employed in the more servile offices, as grooms, footmen, coachmen, &c.
- VALETUDINARY**, among medical writers, denotes a person of a weak and sickly constitution, and frequently out of order.
- VALID**, in law, an appellation given to acts, deeds, transactions, &c. which are clothed with all the formalities requisite to their being put into execution.
- VALLADOLID**, a city of Old Castile, in Spain, eighty-six miles north-west of Madrid: W. long 4° 56', and N. lat. 41° 36'.
- VALLENGIN**, the capital of a county of the same name, in Switzerland, situated near the lake of Neufchattel, twenty five miles north-west of Bern.
- VALLISNERIA**, in botany, a genus of the diœcia dian-dria class. The spathe both of male and female consists of two segments, and the corolla of three petals; the spadix of the male is covered with strobiles; the capsule has one cell, containing many seeds; and there are three styli. There is but one species, a native of Italy.
- VALOIS**, a duchy of France, situated on the three great rivers, the Seine, the Marne and the Oyse.
- VALUE**, in commerce, denotes the price or worth of any thing.
- VALUED RENT**, in Scots law. See LAW, Tit. xii. 6.
- VALVE**, in hydraulics, pneumatics, &c. is a kind of lid, or cover, of a tube or vessel, so contrived as to open one way; but which, the more forcibly it is pressed the other way, the closer it shuts the aperture; so that it either admits the entrance of a fluid into the tube or vessel, and prevents its return; or admits its escape, and prevents its re-entrance.
- VALVE**, in anatomy, a thin membrane applied on several cavities and vessels of the body, to afford a passage to certain humours going one way, and prevent their reflux towards the place from whence they came.
- VAN**, a term derived from the French *avant*, or *avaunt*, signifying *before*, or *foremost* of any thing: thus we say, the van-guard of an army, &c.
- VANDALIA**, the ancient name of the countries of Mecklenburg and Pomerania, in Germany.
- VANELLUS**, in ornithology. See TRINGA.
- VAPOUR**, in philosophy, the moist and most volatile particles of bodies, separated by heat, and raised into the atmosphere. See RAIN.
- VAPOURS**, in medicine, a disease properly called hypo, or the hypochondriacal disease, and in men particularly the spleen. See MEDICINE, p. 148.
- VARI**, in medicine, little hard and ruddy tumours, which frequently infect the faces of young persons of a hot temperament of body.
- VARIATION**, in geography and navigation, is the deviation of the magnetical needle, in the mariner's compass, from the true north point, towards either the east or west; or it is an arch of the horizon, intercepted between the meridian of the place of observation and the magnetic meridian. See NAVIGATION.
- VARIEGATION**, among botanists and florists, the act of streaking or diversifying the leaves, &c. of plants and flowers with several colours.
- Variegation is either natural or artificial. Of natural variegation there are four kinds; the first shewing itself in yellow spots here and there in the leaves of plants called by gardeners the yellow-bloach. The second kind, called the white bloach, marks the leaves with a great number of white spots or stripes; the whitest lying next the surface of the leaves, usually accompanied with other marks of a greenish white, that lie deeper in the body of the leaves. The third, and most beautiful, is where the leaves are edged with white, being owing to some disorder or infection in the juices, which stains the natural complexion or verdure of the plant. The fourth kind is that called the yellow edge.
- Artificial variegation is performed by inarching or inoculating a striped or variegated plant into a plain one of the same sort; as a variegated common jessamin into a plain, common, Spanish, Brazil, or Indian jessamin.
- A single bud or eye, Mr Bradley observed, being placed in the escutcheon of a dis tempered tree, where it can only receive nourishment from the vitiated juices, will become variegated proportionably to the nourishment it draws; and will partake more of the white and yellow juice. than if a branch shall be inarched, the bud having nothing to nourish it but the juices of the plant it is inoculated on; whereas a cyon inarched is fed by the striped plant, and the healthful one.
- As to the natural stripes and variegations, there are some particular circumstances to be observed: 1. That some plants only appear variegated or bloached in the spring and autumn, the stains disappearing as they gather strength: of this kind are rue, thyme, and marjoram. 2. Some plants are continually bloached in the spongy part of their

their leaves, the sap-vessels all the time remaining of a healthful green; which, being strengthened by rich manure, or being inarched in healthful plants, throw off the distemper. 3. In other plants, the disease is so rooted and inveterate, that it is propagated with the seed; such are the arch-angel, water-betony, bark-crefs, borage, striped cellary, and sycamore; the sides of which produce striped plants.

**VARIOLÆ**, the SMALL-POX. See **MEDICINE**, p. 75.

**VARIIX**, in medicine, the dilatation of a vein, arising from the too great abundance or thickness of the blood.

**VARNISH**, a thick, viscid, shining liquor, used by painters, gilders, and various other artificers, to give a gloss and lustre to the works; as also to defend them from the weather, dust, &c.

There are several kinds of varnishes in use; as the siccative or drying varnish, made of oil of aspin, turpentine, and sandarach melted together. White varnish, called also Venetian varnish, made of oil of turpentine, fine turpentine, and mastic. Spirit of wine varnish, made of sandarach, white amber, gum. elmi, and mastic; serving to gild leather, picture-frames, &c. withal.

1. To make the white varnish: take gum fundarach, of the clearest and whitest sort, eight ounces; gum mastic, of the clearest sort, half an ounce; of sarcocolla, the whitest, three quarters of an ounce; Venice turpentine, an ounce and a half; benzoin, the clearest, one quarter of an ounce; white rosin, one quarter of an ounce; gum animæ, three quarters of an ounce: let all these be dissolved, and mixed in the manner following:

Put the sarcocolla and rosin into a little more spirits than will cover them to dissolve; then add the benzoin, gum animæ, and venice-turpentine, into either a glass or glazed earthen vessel, and pour on as much spirits as will cover them an inch; then put the gum mastic into a glass or glazed vessel, and pour strong spirits upon it, covering it also about an inch thick, to dissolve it rightly; then put your gum elemi into a distinct vessel as before, and cover it with spirits to dissolve.

For this purpose, you need only break the rosin a little, and powder the gum animæ, sarcocolla, and benzoin.

Let all stand three or four days to dissolve, shaking the glasses, &c. two or three times a-day, and afterwards put them all together into a glazed vessel, stirring them well, and strain the liquor and gums gently, beginning with the gums, through a linen cloth.

Then put it into a bottle, and let it stand a week before you use it, and pour off as much of the clear only, as you think sufficient for present use.

A hard varnish that will bear the muffle may be thus made: Take of colophony, an ounce; set it over the fire in a well-glazed earthen vessel, till it is melted; then by little and little, strew in two ounces of powder of amber, keeping it stirring all the while with a stick; and when you perceive it begin to harden or resist the stick, then put in a little turpentine oil, which will thin and soften it immediately; then put in two ounces of gum copal, finely powdered, sprinkling it in as you did the amber, now and then pouring in a little oil of turpentine; and when it is done, strain it as before directed.

This is proper to varnish over gold; and the things done with it must be set into a declining oven, three or

four days successively, and then it will resist even the fire itself.

To make a varnish for gold, or metals made in imitation of gold. Take colophony, and, having melted it, put in two ounces of amber finely powdered, and some spirit of turpentine; and, as the amber thickens, keep it well stirring; then put in an ounce of gum elemi, well pulverized, and more spirit of turpentine; constantly stirring the liquor till all is well mixed and incorporated; but take care, however, to use as little turpentine as you can, because the thicker the varnish is made, the harder it will be. Let this be done over a sand-heat, in an open-glass; then strain it, as is directed for the preceding varnish. This varnish is to be used alone, first warming the vessels made of paper paste; and lay it on with a painting-brush before the fire, but not too near, lest the fire raise it into blisters. After this has been done, harden it three several times in ovens; first with a slack heat, the next with a warmer, and the third with a very hot one; and the vessels will look like polished gold.

And as for such vessels, &c. as shall be made with saw dust and gums, the varnish may be made of the same ingredients as above-mentioned, except the gum elemi; and this will dry in the sun, or in a gentle warmth.

To make a varnish for any thing covered with leaf-silver. First paint the thing over with size, and ground chalk or whiting; let them stand till they are thoroughly dry, and then do them over with very good gold-size of a bright colour (for there is much difference in the colour of it, some being yellow, and others almost white; the first is most proper for gold, and the last for silver). When this size is so dry as that it will just stick a little to the touch, lay on the leaf-silver, and close it well to the size.

To make a varnish for silver. Melt, in a well-glazed pipkin, some fine turpentine, and put in three ounces of white amber finely powdered (more or less, according to the quantity your work will require;) put it in by little and little, keeping it continually stirring, adding by degrees some spirit of turpentine, till all the amber is dissolved; and then add to it an ounce of sarcocolla well beaten, and an ounce of gum elemi well levigated, adding now and then a little spirit of turpentine, till all is dissolved: do this over a gentle fire, and keep it constantly stirring.

This varnish will be as white and strong as the former; and is to be used warm, and hardened by degrees in an oven, as varnished gold, whereby it will look like polished silver.

**Laying on of VARNISHES.** 1. If you varnish wood, let your wood be very smooth, close-grained, free from grease, and rubbed with rushes. 2. Lay on your colours as smooth as possible; and, if the varnish has any blisters in it, take them off by a polish with rushes. 3. While you are varnishing, keep your work warm, but not too hot. 4. In laying on your varnish, begin in the middle, and stroke the brush to the outside; then to another extreme part, and so on till all be covered; for if you begin at the edges, the brush will leave blots there, and make the work unequal. 5. In fine works use the finest tripoli in polishing: do not polish it at one time only; but after the first time, let it dry for two or three days, and polish it again for the last time. 6. In the first polishing, you must use a good deal of tripoli; but in the next a very

little will serve: when you have done, wash off your tri-poli with a sponge and water: dry the varnish with a dry linen rag; and clear the work, if a white ground, with oil and whiting; or, if black, with oil and lamp black.

**VARNISH** also signifies a sort of shining coat, wherewith potter's ware, delf ware, china ware, &c. are covered, which gives them a smoothness and lustre. Melted lead is generally used for the first, and smalt for the second.

**VARNISH**, among medalists, signifies the colours antique medals have acquired in the earth.

The beauty which nature alone is able to give to medals, and art has never yet attained to counterfeit, enhances the value of them; that is, the colour, which certain soils, in which they have a long time lain, tinges the metals withal: some of which are blue, almost as beautiful as the turquoise; others with an inimitable vermilion colour; others with a certain shining polished brown, vastly finer than brass figures.

The most usual varnish is a beautiful green, which hangs to the finest strokes without effacing them, more accurately than the finest enamel does on metals.

No metal but brass is susceptible of this; for the green rust that gathers on silver always spoils it, and it must be got off with vinegar or lemon-juice.

Falsifiers of medals have a false or modern varnish, which they use on their counterfeits, to give them the appearance, or air, of being antique. But this may be discovered by its softness, it being softer than the natural varnish, which is as hard as the metal itself.

Some deposit their spurious metals in the earth for a considerable time, by which means they contract a sort of varnish, which may impose upon the less knowing; others use sal armoniac, and others burnt paper.

**VAS**, a vessel either for mechanical, chemical, culinary, or any other uses: In anatomy, all the parts which convey a fluid are called vessels, as the veins, arteries, and lymphatics,

**VASCULAR**, something consisting of divers vessels; as arteries, veins, nerves, &c.

**VASCULIFEROUS PLANTS**, such whose seeds are contained in vessels, which are sometimes divided into cells.

**VASE**, a term frequently used for ancient vessels dug from under ground, or otherwise found, and preserved in the cabinets of the curious.

In architecture, the appellation vase is also given to those ornaments placed on corniches, soffles, or pedestals, representing the vessels of the ancients, particularly those used in sacrifice: as incense-pots, flower-pots, &c.

**VASSAL**, denotes a tenant that holds land in fee of his lord. **VASSAL**, in Scots law. See **LAW**, Tit. x. 3.

**VASTUS**, in anatomy. See **ANATOMY**, p. 207.

**VATERIA**, in botany, a genus of the polyandria monogynia class. The corolla consists of five petals, and the calix of five segments; the capsule has three valves, and one cell containing three seeds. There is but one species, a native of India.

**VATICAN**, a magnificent palace of the pope, in Rome, which is said to consist of several thousand rooms: but the parts of it most admired are the grand stair-case, the pope's apartment; and especially the library, which is one of the richest in the world, both in printed books and manuscripts.

**VAUDEMONT**, the capital of a county of the same name in Lorrain, fifteen miles south-west of Nancy.

**VAUDOIS**, are certain valleys situated north of the marquisate of Saluzzo, in Italy: the chief town is Lucerne.

**VAULT**, in architecture, an arched roof, so contrived that the stones which form it sustain each other.

Vaults are, on many occasions, to be preferred to soffits or flat ceilings, as they give a greater height and elevation, and are besides more firm and durable.

**VAUR**, a town of Languedoc, in France, eighteen miles west of Toulouse.

**UBEDA**, a city of Andalusia, in Spain, forty-five miles north-east of Granada: W. long. 3° 6', N. lat. 38°.

**UBERLINGEN**, a town of Swabia, in Germany, ten miles north of Constance.

**UBES**, or *St. Ubes*, a city and port-town of Portugal, situated on a fine bay, twenty-one miles south of Lisbon.

**UBIQUITARIANS**, in church-history, a sect of heretics who sprung up in Germany about the year 1590, and maintained that the body of Jesus Christ is *ubique*, everywhere, or in every place, at the same time. However, they were not quite agreed among themselves; some holding, that the body of Jesus Christ, even during his mortal life, was every where; and others dating the ubiquity of his body from the time of his ascension only.

**UBIQUITY**, omnipresence: an attribute of the Deity, whereby he is always intimately present to all things.

**UDDER**, that part in brutes wherein the milk is prepared; answering to the mamme, or breasts, in women.

**VECTOR**, in astronomy, a line supposed to be drawn from any planet moving round a centre, or the focus of an ellipse, to that centre or focus.

**VEDETTE**, in the military art, a sentinel on horseback, detached from the main body of the army to discover and give notice of the enemy's designs.

**VEER**, a sea term variously used. Thus veering out a rope, denotes the letting it go by hand, or letting it run out of itself. It is not used for letting out any running rope except the sheet.

**VEER** is also used in reference to the wind; for, when it changes often, they say it veers about.

**VEGETABLE**, a term applied to all plants, considered as capable of growth; *i. e.* all natural bodies which have parts organically formed for accretion, but not sensation.

**VEGETATION**, the act whereby plants receive nourishment; and grow. See **AGRICULTURE** p. 40.

**VEGETATIVE SOUL**, among philosophers, denotes that principle in plants, by virtue of which they vegetate, or receive nourishment and grow.

**VEHICLE**, in general, denotes any thing that carries or bears another along; but is more particularly used in pharmacy for any liquid serving to dilute some medicine, in order that it may be administered more commodiously to the patient.

**VEIL**, a piece of stuff, serving to cover or hide any thing.

In the Romish churches, in time of Lent, they have veils or curtains over the altar, crucifix, images of saints, &c.

A veil or crape is worn on the head by nuns, as a badge of their profession: the novices wear white veils; but those who have made the vows black ones.

**VEIN**, in anatomy. See **ANATOMY**, p. 237.

**VEIN**, among miners, is that space which is bounded with woughs, and contains ore, spar, canck, clay, chirt, creil, brownen,

- brownen, pitcher-shirt, cur, which the philosophers call the mother of metals, and sometimes foil of all colours. When it bears ore, it is called a quick vein; when no ore, a dead vein.
- VELA**, a remarkable cape on the coast of Terra Firma, in W. long.  $73^{\circ} 30'$ , and N. lat.  $12^{\circ}$ .
- VELARIUS**, in antiquity, an officer in the court of the Roman emperors, being a kind of usher, whose post was behind the curtain in the prince's apartments; as that of the chancellor's was at the entry of the balustrade, and that of the ostiarii at the door. The velarii had a superior of the same denomination who commanded them.
- VELAY**, the north-east division of Languedoc, in France.
- VELITES**, in the Roman army, a kind of ancient soldiery, who were armed lightly with a javelin, a cask, cuirasse, and shield.
- VELLEITY**, in the school-philosophy, is usually defined a languid, cold, and remiss will. Others say, it implies an impotency of obtaining what we require.
- VELLA**, in botany, a genus of the tetradynamia filiculosa class. The dissepimentum of the pod is about twice as large as the valves, and oval on the outside. There are two species, only one of them, *viz.* the annua, or cresrocket, a native of Britain.
- VELOCITY**, swiftness, or that affection of motion whereby a moving body is disposed to run over a certain space in a certain time. See **MECHANICS**, and **HYDROSTATICS**.
- VELVET**, a rich kind of stuff, all silk, covered on the outside with a close, short, fine, soft shag, the other side being a very strong close tissue.
- The principal and best manufactories of velvet are in France and Italy, particularly in Venice, Milan, Florence, Genoa, and Lucca: there are others in Holland, set up by the French refugees, whereof that at Harlem is the most considerable; but they all come short of the beauty of those in France.
- VENAL** or **VENOUS**, among anatomists, &c. something that bears a relation to the veins.
- This word is also used for something bought with money, or procured by bribes.
- VENEERING**, a kind of marquetry, or inlaying, whereby several thin slices or leaves of fine woods, of different kinds, are applied and fastened on a ground of some common wood.
- VENEREAL**, something belonging to venery; as the luës venerea. &c.
- VENERY**, is used for the act of copulation, or coition, of the two sexes.
- VENESECTION**, or **PHLEBOTOMY**, in surgery. See **SURGERY** p. 641.
- VENETIAN BOLE**, a fine red earth used in painting, and called in the colour-shops Venetian red.
- It is dug in Carinthia, and sent from Venice to all parts of the world, being an excellent colour, and very cheap: our colour-men, however, find many ways of adulterating it.
- VENEZUELA**, a province of Terra Firma, lying on the northern ocean, and having new Andalusia on the east, new Granada on the south, and the river De la Hacha on the west.
- VENIAL**, in the Romish theology, a term applied to slight sins, and such as easily obtain pardon.
- VENICE**, the capital of a republic in Italy, of the same name, is situated in the Lagunes, or small islands, of the gulph of Venice, about five miles from the continent: E. long.  $13^{\circ}$ , and N. lat.  $45^{\circ} 40'$ .
- Venice is so happily situated, that no army can approach it by land; the avenues to those islands being so exceeding difficult, that they have not thought it necessary to inclose the city with a wall.
- Nothing can appear more beautiful than this city, as we approach it either from the continent or the sea, with its numerous palaces and lofty towers: its circumference is about six miles, and its inhabitants are computed at two hundred thousand.
- VENIRE FACIAS**, in law, is a judicial writ lying where two parties plead and come to issue; directed to the sheriff, to cause twelve men, of the same neighbourhood, to meet, and try the same, and to say the truth upon the issue taken.
- VENT**, **VENT-HOLE**, or **SPIRACLE**, a little aperture left in the tubes or pipes of fountains, to facilitate the air's escape; or, on occasions, to give them air, as in frosty weather, &c. for want of which they are apt to burst.
- VENTER**, in anatomy, the same with abdomen. See **ANATOMY**, p. 256.
- VENTIDUCTS**, in building, are spiracles or subterraneous places, where fresh, cool wind being kept, they are made to communicate, by means of tubes, funnels, or vaults, with the chambers or other apartments of a house, to cool them in sultry weather.
- VENTILATOR**, a well-known machine, by which the noxious air of any close place, as an hospital, goal, ship, chamber, &c. may be changed for fresh air.
- VENTRICLE**, properly denotes any little cavity; but is more particularly used, by physicians and anatomists, for the stomach.
- VENUS**, in astronomy. See **ASTRONOMY**, p. 436.
- VERA CRUZ**, a port-town of Mexico, with a strong and commodious harbour, situated on the gulph of Mexico, in W. long.  $100^{\circ}$ , N. lat.  $18^{\circ} 30'$ .
- VERAGUA**, a province of Mexico, situated on the South Sea, westward of the gulph of Panama.
- VERATRUM**, in botany, a genus of the polygamia monoecia class. Neither male nor hermaphrodite have any calix; the corolla of each consists of six petals, and they have each six stamina; the hermaphrodite has three pistilli, and three capsules containing many seeds. There are three species, none of them natives of Britain.
- VERB**; in grammar. See **GRAMMAR**, p. 734.
- VERBAL**, something that belongs to verbs, or even to words of any kind spoken with the mouth.
- VERBAL AGREEMENT**, in Scots law. See **LAW**, Tit. xxi. 1, &c.
- VERBASCUM**, in botany, a genus of the pentandria monogynia class. The corolla is rotated, and somewhat unequal; and the capsule has two cells, and two valves. There are twelve species, four of them natives of Britain, *viz.* the thapsus, or great white mullein, the leaves of which are emollient; the lychnitis, or hoary mullein; the nigrum, or black mullein; and the blattoria, or yellow moth-mullein.
- VERBENA**, in botany, a genus of the diandria monogynia class. The corolla is funnel-shaped, and crooked; one tooth of the calix is truncated; and it has two or four

four naked seeds. There are 16 species, only one of them, *viz.* the officinalis, or vervain, a native of Britain.

**VERBERATION**, in physics, a term used to express the cause of sound, which arises from a verberation of the air, when struck in divers manners by the several parts of the sonorous body first put into a vibratory motion.

**VERBESINA**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is paleaceous; the pappus is furnished with an awn; the calix is double; and it has about five floscules in the radius. There are 13 species, none of them natives of Britain.

**VERD**, or **CAPE-VERD**, a promontory of Africa, forty miles north-west of the mouth of the river Gambia: W. long. 18°, N. lat. 15°.

There are a number of islands in the Atlantic ocean, called Cape-Verd islands, from their being situated off this cape.

**VERDIGREASE**, a kind of rust of copper, much used by painters as a green colour.

Verdigrease is properly no other than copper dissolved by a mild acid into the form of an ærugo, or rust.

This rust of copper is rarely used internally; nor ought it, unless in the most desperate case, where instantaneous vomiting is necessary. Externally it is much used as a detergent or desiccative: it eats off fungous flesh in ulcers, and, mixed with honey, is used in aphthæ and ulcerations of the mouth.

**VERDICT**, is the answer of the jury given to the court, concerning the matter of fact, in any case civil or criminal, committed by the court to their trial and examination.

**VERDITER**, or **VERDETER**, a kind of mineral substance, sometimes used by the painters, &c. for a blue; but more usually mixed with a yellow for a green colour.

**VERDOY**, in heraldry, denotes a bordure of a coat of arms, charged with any kinds or parts of flowers, fruits, seeds, plants, &c.

**VERGETTE**, in heraldry, denotes a pallet, or small pale; and hence, a shield divided by such pallets is termed vergette. See **PALE**.

**VERIFICATION**, in general, is the act of proving a thing; but among the French, it only signifies the recording of the king's edicts by the parliament.

**VERJUICE**, a liquor obtained from grapes or apples, unfit for wine or cyder; or from sweet ones, whilst yet acid and unripe. Its chief use is in sauces, ragouts, &c. though it is also an ingredient in some medicinal compositions, and is used by the wax-chandlers to purify their wax.

**VERMICELLI**, a composition of flour, cheese, yolks of eggs, sugar, and saffron, reduced to a paste, and formed into long slender pieces like worms, by forcing it with a piston through a number of little holes.

It was first brought from Italy, where it is in great vogue: it is chiefly used in soups and pottages, to provoke venery, &c.

**VERMICULAR**, an epithet given to any thing that bears a relation or resemblance to worms.

**VERMIFORMIS**, in anatomy, a term applied to various parts in the human body, bearing some resemblance to worms.

**VERMILION**, a very bright and beautiful red colour,

in great esteem among the ancients, under the name of minium. There are two kinds of it, the one natural, the other factitious. The natural is found in some silver mines, in the form of a ruddy sand, which is afterwards prepared and purified by several lutions and coctions. The artificial is made of mineral cinnabar, ground up with aqua-vitæ and urine, and afterwards dried.

It is also made of lead burnt and washed, or of cerus prepared by fire: but this is not properly called vermilion, but minium, or red-lead.

**VERMIN**, a collective name including all kinds of little animals, or insects, which are hurtful or troublesome to men, beasts, fruits, &c. as worms, lice, fleas, caterpillars, ants, flies, &c.

**VERNACULAR**, is applied to any thing that is peculiar to some one country.

**VERNAL**, something belonging to the spring season.

**VERONA**, a city of Italy, in the territory of Venice, capital of the Veronese, situated on the Adige: E. long. 11° 15', N. lat. 45° 20'.

**VERONICA**, in botany, a genus of the diandria monogynia class. The corolla is rotated, and consists of four segments, the lowest one being less than all the rest; and the capsule has two cells. There are 34 species, 13 of them natives of Britain.

**VERSAILLES**, a town of France, in the province of the isle of France, situated eleven miles west of Paris, where stands one of the most elegant and magnificent palaces in the world, built by Lewis XIV.

**VERSE**, in poetry, a line or part of a discourse, consisting of a number of long and short syllables, which run with an agreeable cadence, the like being also reiterated in the course of the piece.

**VERSE**, is also used for a part of a chapter, section, or paragraph, subdivided into several little articles.

**VERSIFICATION**, the art or manner of making verse; also the tune and cadence of verse.

Verseification is properly applied to what the poet does more by labour, art, and rule, than by invention.

**VERSION**, a translation of some book or writing, out of one language into another.

**VERT**, in heraldry, the term for a green colour. It is called vert in the blazon of the coats of all under the degree of nobles; but in coats of nobility, it is called emerald; and in those of kings, venus. In engraving, it is expressed by diagonals, or lines drawn athwart from right to left, from the dexter chief corner to the sinister base, as represented in Plate CXLVII. fig. 23.

**VERTEBRÆ**, in anatomy. See **ANATOMY**, p. 166.

**VERTEX**, in anatomy, denotes the crown of the head.

Hence vertex is also used figuratively, for the top of other things: thus, the vertex of a cone, pyramid, &c. is the top of any one of these figures.

**VERTEX** is also used in astronomy, for the point of heaven perpendicularly over our heads, properly called the zenith.

**VERVICILLATE PLANTS**. See **BOTANY** p. 637.

**VERTICITY**, is that property of the loadstone, whereby it turns, or directs itself to some peculiar point.

**VETIGO**, in medicine. See **MEDICINE**, p. 146.

**VERVAIN**, in botany. See **VERBENA**.

**VERU-MONTANUM**, in anatomy. See **ANATOMY**, p. 273:

**VESICA**,

VESICA, in anatomy. See ANATOMY, p. 269.

VESICATORIUM, an external medicine, serving to raise a blister; whence also it is itself, though improperly, called a blister.

We have vesicatories made of cantharides, euphorbium, figs, sublimate of mercury, lapis infernalis, mustard, anacardium, squills, briony, vinegar, pepper, leaven, &c. VESICULA, a diminutive of vesica, signifying a little bladder.

VESPA, the WASP, in zoology, a genus of insects belonging to the order of hymenoptera. The mouth consists of two jaws without any proboscis; the superior wings are plaited; there is a sharp sting in the tail; and the eyes are lunar. There are 28 species. The common wasps live in societies like the bee. See APIS.

VESPERS, in the church of Rome, denote the afternoon service; answering, in some measure, to the evening-prayers of the church of England.

VESPERTILIO, the BAT, in zoology, a genus of quadrupeds belonging to the order of primates. All the teeth are erect, pointed, near each other, and the first four are equal; the fore-feet have the toes connected by a membrane expanded into a kind of wings, by which the creature is enabled to fly. They fly about in the night, and feed upon moths.

VESPERTILIONUM ALÆ, in anatomy. See ANATOMY, p. 275.

VESSEL, denotes in general any thing for holding liquors; such are our domestic cups, pots, &c. as also the retorts, matrasses, crucibles, &c. For the theory and construction of chemical vessels, see CHEMISTRY, p. 108.

In anatomy, all the parts which contain or convey a fluid are called vessels; as the veins, arteries, lymphatics.

VESSEL, in navigation, a general name for all sorts of ships. See SHIP.

VESTALIA, in Roman antiquity, a festival celebrated in honour of the goddess Vesta, on the fifth of the ides of June; that is, on the ninth of that month.

VESTALS, among the ancient Romans, were priestesses of the goddess Vesta, and had the perpetual fire committed to their charge: they were at first only four in number, but afterwards increased to six; and it does not appear that their number ever exceeded six, among whom one was superior to the rest, and called *vestalis maxima*.

The vestals were chosen from six to ten years of age, and obliged to strict continency for thirty years; the first ten of which were employed in learning the ceremonies of religion, the next ten in the performance of them, and the ten last in teaching them to the younger vestals.

The habit of the vestals consisted of an head-dress, called *infula*, which sat close to their heads, and from whence hung certain laces called *vittæ*; a kind of surplice made of white linen, and over it a purple mantle with a long train to it.

VESTIBLE, in architecture, a kind of entrance into a large building; being an open place before the hall, or at the bottom of the stair-case.

VESTIBLE of the ear, in anatomy. See ANATOMY, p. 297.

VESTRY, a place adjoining to a church, where the vestments of the minister are kept; and also a meeting at such place, consisting of the minister, church-wardens, and chief men of most parishes, who make a parish vestry or meeting.

By custom there are select vestries, being a certain number of persons chosen to have the government of the parish, make rates, and take the accounts of church-wardens, &c.

VESUVIUS, a famous volcano, or burning mountain, situated only six miles east of the city of Naples, in Italy. See VOLCANO.

VETCH, in botany. See VICIA.

VETERAN, among the ancient Romans, an appellation given to a soldier who was grown old in the service, or had made a certain number of campaigns.

VIALES, in mythology, a name given among the Romans to the gods who had the care and guard of the roads and high-ways.

VIATICUM, in the church of Rome, an appellation given to the eucharist when administered to persons at the point of death.

VIATOR, in Roman antiquity, an appellation given in common to all officers of any of the magistrates; as *listors*, *accensi*, *scribes*, *criers*, &c.

VIBEX, is sometimes used, by physicians, for a black and blue spot in the skin, occasioned by an afflux or extravasation of blood.

VIBRATION, in mechanics, a regular, reciprocal motion of a body, as a pendulum, &c.

VIBURNUM, in botany, a genus of the pentandria trigynia class. The calix is above the fruit, and consists of five segments; the corolla has likewise five segments, and the berry contains one seed. There are nine species, two of them natives of Britain, *viz.* the *lantana*, or *way-faring tree*; and the *opulus*, or *water-elder*.

VICAR, a person appointed, as deputy to another, to perform his functions in his absence, and under his authority.

VICAR, in the canon law, denotes a priest of a parish, the predial tithes whereof are impropriated or appropriated; that is, belong either to a chapter, religious house, &c. or to a layman, who receives them, and only allows the vicar the small tithes, or a convenient salary.

VICE, in ethics, is ordinarily defined an elective habit, deviating, either in excess, or defect, from the just medium wherein virtue is placed.

VICE, in smithery, and other arts employed in metals, is a machine, or instrument, serving to hold fast any thing they are at work upon, whether it is to be filed, bent, rivetted, &c.

VICE is also used, in the composition of divers words, to denote the relation of something that comes instead, or in the place, of another; as *vice-admiral*, *vice-chancellor*, *vice-chamberlain*, *vice-president*, &c. are officers who take place in the absence of admirals, &c.

VICE-ROY, a governor of a kingdom, who commands in the name and stead of a king, with full and sovereign authority. See KING.

VICIA, in botany, a genus of the diadelphia decandria class. The under side of the stigma is transversely bearded. There are 18 species, six of them natives of Britain, *viz.* the *cracca*, or *tufted wood-vetch*; the *sepium*, or *bush-vetch*; the *fativa*, or *common vetch*; the *lathyroides*, or *wild-vetch*; and the *lutea*, or *yellow vetch*.

VICISSITUDE, the regular succession of one thing after another; as the vicissitude of day and night, of the seasons, &c.

VISCOUNT, a degree of nobility next below a count, or earl, and above a baron.

VICTIM, denotes a bloody sacrifice, offered to some deity.

- of a living creature, as a man or beast, which is slain to appease his wrath, or obtain some favour.
- VICTIMARIUS**, in antiquity, a minister or servant of the priest, whose office was to bind the victims, and prepare the water, knife, and other things necessary for the sacrifice.
- VICTORY**, the overthrow or defeat of an enemy, in war or combat.
- VICTUALLING-OFFICE**, an office kept on Tower-hill, London, for the furnishing his majesty's navy with victuals.
- VICTUALS**, signifies any sustenance, or things necessary to live upon, as meat and provisions.
- VIENNA**, the capital city of the circle of Austria and of the German empire, is situated on the Danube, in E. long.  $16^{\circ} 21'$ , and N. lat.  $48^{\circ} 20'$ .  
Viennâ is an archbishop's see; and has a celebrated university.
- VIGILS**, in church history, are the fasts appointed before certain festivals, in order to prepare the mind for a due observation of the ensuing solemnity.
- VIGO**, a port-town of Galicia, in Spain. 70 miles south-east of Cape Finisterre: W. long.  $9^{\circ} 18'$ , N. lat.  $42^{\circ} 15'$ .
- VILLA FRANCA**, the name of several towns, one in Piedmont, three miles east of Nice; another of Catalonia, eighteen miles west of Barcelona; a third, the capital of St Michael, one of the Azores; and a fourth, a town of Eltremadura, in Spain, fifty-four miles south-east of Salamanca.
- VILLA FRANCHE**, a town of Orleansois, in France, twelve miles north of Lyons.
- VILLAGE**, an assemblage of houses, inhabited chiefly by peasants and farmers, and having no market, whereby it is distinguished from a town.
- VILLAIN**, or **VILLEIN**, in our ancient customs, denotes a man of servile and base condition, viz. a bondman or servant.
- VILLA REAL**, the name of two towns; the one in Spain, thirty miles north of Valencia; and the other in Portugal, fifty miles east of Porto.
- VILLA RICA**, a port-town of Mexico, situated on the gulph of Mexico, in W. long.  $100^{\circ}$ , and N. lat.  $20^{\circ}$ .
- VILLENAGE**, a kind of ancient tenure, whereby the tenant was bound to do such services as the lord commanded, or such as were fit for villains or bondmen to perform.
- VILLI**, among botanists, a kind of down, like coarse hair, with which some trees abound.
- VILLOSE**, or **VILLOUS**, something abounding with villi, or fibres like coarse hairs: such is one of the coats of the stomach.
- VINALIA**, in Roman antiquity, a festival on the ninth of the kalends of May, in honour both of Jupiter and Venus.
- VINCA**, in botany, a genus of the pentandria monogynia class. It has two erect follicles; the seeds are plumose; and the tube of the corolla terminates in a lacerated corona. There are four species, two of them natives of Britain, viz. the minor, or periwinkle; and major, or greater periwinkle.
- Cape VINCENT**, the most south-west promontory of Portugal: W. long.  $10^{\circ}$ , and N. lat.  $36^{\circ} 55'$ .
- St VINCENT**, one of the Caribbee islands, seventy-five miles west of Barbadoes.
- St VINCENT**, is also a province of Brazil, bounded by the Rio Janiero on the north, by the Atlantic on the east, by the province of del Rey on the south, and by that of the Spanish La Plata on the west.
- VINDEMIATING**, the gathering of the grapes, or other ripe fruits, as apples, pears, cherries, &c.
- VINDEMIATRIX**, or **VINDEMIATOR**, a fixed star of the third magnitude in the constellation virgo.
- VINE**. See **VITIS**.
- VINEGAR**, an acid penetrating liquor, prepared from wine, cyder, beer, &c. of considerable use both as a medicine and sauce. See **CHEMISTRY**, p. 97, 166.
- VINEYARD**, a plantation of vines.  
The best situation of a vineyard is on the declivity of an hill, lying on the south.
- VINOUS**, something that relates to wine, or that has the taste and smell thereof. See **WINE**.
- VINTAGE**, a crop of wine, or what is got from the vines each season.
- VINUM**, a liquor or drink commonly called wine. See **WINE**.
- VIOL**, a musical instrument of the same form with the violin, and struck like that with a bow.
- VIOLA**, in botany, a genus of the syngenesia monogynia class. The calix consists of five leaves, and the corolla of five irregular petals horned behind; the capsule has three valves, and one cell. There are 24 species, seven of them natives of Britain.
- VIOLATION**, the act of violating, that is, forcing a woman, or committing a rape upon her.  
This term is also used in a moral sense, for a breach or infringement of a law, ordinance, or the like.
- VIOLENT**, in the schools, a thing done by force; in which sense it stands opposed to spontaneous.
- VIOLENT Profits**, in Scots law. See **LAW**, Tit. xiii. 20.
- VIOLET**, in botany. See **VIOLA**.
- VIOLIN**, or **FIDDLE**, a musical instrument mounted with four strings, or guts, and struck, or played, with a bow.
- VIOLONCELLO**, of the Italians is properly our fifth violin; which is a little bass-violin, half the size of the common bass-violin, and its strings just half as thick and half as long, which renders the sound just an octave higher than the same.
- VIOLONE** in music, a double bass, almost twice as big as the common bass-violin, and the strings bigger and longer in proportion, and consequently its sound an octave lower than that of our bass-violin, which has a noble effect in great concerts.
- VIPER**, in zoology. See **COLUBER**.
- VIRAGO**, a woman of extraordinary stature and courage; and who, with the female sex, has the men and air of a man, and performs the actions and exercises of men.
- VIRGA AUREA**, in botany. See **SOLIDAGO**.
- VIRGA SANGUINEA**, in botany. See **CORNUS**.
- VIRGIN**, a female who has had no carnal commerce with man.  
**VIRGIN** is also applied figuratively to several things that retain their absolute purity, and have never been made use of.
- VIRGIN-ISLANDS**, very small islands of the Caribbees, situated in the Atlantic or American-ocean, a little to the eastward of Porto-Rico.
- VIRGINIA**, one of the British American colonies, situated between seventy-four and eighty degrees east long. and between thirty-six and thirty-nine degrees of north lat.

- lat. bounded by the river Patowmack, which separates it from Maryland, on the north; by the Atlantic-ocean, on the east; by Carolina, on the south; and may be extended as far westward as we think fit.
- VIRGINITY**, the test or criterion of a virgin, or that which intitles her to the denomination.
- VIRGO**, in astronomy, one of the signs or constellations of the zodiac. See **ASTRONOMY**, p. 487.
- VIRILE**, something that belongs or is peculiar to a man, or the male sex.
- VIRTUAL**, or **POTENTIAL**, something that has a power or virtue of acting or doing. The term is chiefly understood of something that acts by a secret invisible cause, in opposition to actual and sensible.
- VIRTUE**, a term used in various significations. In the general it denotes power, or perfection of any thing, whether natural or supernatural, animate or inanimate, essential or accessory. But in its more proper or restrained sense, virtue signifies an habit, which improves and perfects the possessor and his actions.
- VIRTUOSO**, an Italian term, lately introduced into English, signifying a man of curiosity and learning, or one who loves and promotes the arts and sciences: but among us the term seems to be appropriated to those who apply themselves to some curious and quaint, rather than immediately useful, art or study, as antiquaries, collectors of rarities of any kind, microscopical observers, &c.
- VIRULENT**, a term applied to any thing that yields a virus, that is, a contagious or malignant pus.
- VISCERA**, in anatomy, a term signifying the same with entrails, including the heart, liver, lungs, spleen, intestines, and other inward parts of the body. See **ANATOMY**, Part VI.
- VISCIDITY**, or **VISCOSITY**, the quality of something that is viscid or viscous, that is, glutinous and sticky, like bird-lime, which the Latins call by the name *viscus*.
- VISCUM**, in botany, a genus of the dicotyledon tetrandria class. The calix of both male and female consists of four segments; neither of them have any corolla; there are no filaments in the male, the anther being connected to the calix; the female has no stylus; and the berry contains one heart-shaped seed. There are six species, none of them natives of Britain.
- VISIBLE**, something that is an object of sight or vision, or something whereby the eye is affected, so as to produce a sensation.
- VISIER**, an officer or dignitary in the Ottoman empire, whereof there are two kinds; the first, called by the Turks visier-azem, that is, grand visier, is the prime minister of state of the whole empire. He commands the army in chief, and presides in the divan or great council. Next to him are six other subordinate visiers, called visiers of the bench, who officiate as his counsellors, or assessors in the divan.
- VISION**, in optics, the act of seeing or perceiving external objects, by means of the organ of sight, the eye. See **ANATOMY**, p. 289. and **OPTICS**.
- VISTULA**, or **WEISSEL**, a large river of Poland, which, taking its rise in the mountains south of Silesia, visits Cracow, Warsaw, &c. and continuing its course north, falls into the Baltic sea below Dantzick.
- VISUAL**, in general, something belonging to vision.
- VITAL**, in physiology, an appellation given to whatever
- ministers principally to the constituting or maintaining of life in the bodies of animals: thus, the heart, lungs, and brain are called vital parts; and those operations of these parts, whereby the life of animals is maintained, are called vital functions.
- VITEX**, in botany, a genus of the didynamia angiospermia class. The corolla consists of six segments, and the calix of five teeth; and the berry contains four seeds. There are four species, none of them natives of Britain.
- VITIS**, the **VINE**, in botany, a genus of the pentandria monogynia class. The petals adhere at the apex; and the berry contains five seeds. There are seven species, none of them natives of Britain.
- VITIS IDÆA**, in botany. See **VACCINIUM**.
- VITIOUS INTROMISSION**, in Scots law. See **LAW**, Tit. xxviii. 20.
- VITREOUS Humour of the Eye**. See **ANATOMY**, p. 289.
- VITRIFICATION**, in chemistry, is the converting a body into glass, by means of fire.
- VITRIOL**, a compound body formed of the particles of metals dissolved by the acid of sulphur, and that either by the operations of nature within the earth, or in the chemists laboratory by proper admixtures and assistances, and afterwards, by the help of water, brought into the form of a salt. See **CHEMISTRY**, p. 81, 132.
- VITRIOLATED**, among chemists, something that has vitriol infused in it.
- VITRIOLIC**, an appellation given to whatever abounds with, or partakes of, the nature of vitriol: thus such fossil bodies as contain vitriol, are called vitriolic minerals, or ores of vitriol.
- VITTA**, in anatomy, that part of the amnios which sticks to an infant's head when just born.
- VITUS'S DANCE**. See **MEDICINE**, p. 99.
- VIVERRA**, in zoology, a genus of quadrupeds belonging to the order of feræ. They have six fore-teeth, the intermediate ones being shorter, and more than three grinders; and the claws are exerted. There are six species, viz. 1. The ichneumon, with the tail tapering towards the point, and the toes distant from each other. It is a native of Egypt and India, where it is tamed, and follows its master like a dog. It feeds upon lizards, frogs, &c. and is particularly an enemy to serpents. 2. The nasia, is reddish, with white rings on the tail. It is a native of America, and digs the ground in search of worms; it feeds likewise upon mice, and fruits; when enraged, it sends forth an abominable stench. 3. The narica is of a dusky colour; it is likewise a native of America. 4. The putorius varies in colour, but has generally four white parallel lines on the back. It is a native of North America, is slow in its motion, and emits its urine, attended with a most disagreeable smell, when enraged. 5. The zibetha, has an annulated tail, and the back is streaked with waves of black and ash-colour. It is a native of China, and Mexico. It is a fierce and ungovernable animal, and erects the hairs of its back when angry. 6. The genetia has an annulated tail, and the body is spotted with a dirty yellow and black colour. It is a native of the East, and smells of musk.
- VIVIPAROUS**, in natural history, an epithet applied to such animals as bring forth their young alive and perfect; in contradistinction to them that lay eggs, which are called oviparous animals.

UKRAIN, a province of Muscovy, lying northwards of Little Tartary, so called as being a frontier against Turkey.

ULADISLAW, a city of Great Poland, situated on the river Boristhenes, eighty-miles north-west of Warsaw: E. long. 19°, and N. lat. 53°.

ULCER, in surgery. See SURGERY, p. 646.

ULCERATION, in surgery, a little hole in the skin, caused by an ulcer.

ULEX, in botany, a genus of the diadelphia decandria class. The calix consists of two leaves; and the pod is about the length of the calix. There are two species, one of them, *viz.* the europæus, or furze, a native of Britain.

ULIGINOUS, in agriculture, an appellation given to a moist, moorish, and fenny soil.

ULLAGE, in gauging, is so much of a cask or other vessel, as it wants of being full.

ULM, an imperial city of Swabia, in Germany, ninety miles south-west of Ratisbon: E. long. 10°, N. lat. 48° 24'.

ULMARIA, in botany. See FILIPENDULA.

ULMUS, in botany, a genus of the pentandria digynia class. The calix consists of five segments; it has no corolla; and the berry is dry, compressed, and membranaceous. There are three species, two of them natives of Britain, *viz.* the campestris, or common elm; and the glabra, or broad-leaved elm.

ULNA, in anatomy. See ANATOMY, p. 178.

ULNARIS, in anatomy. See ANATOMY, p. 199.

ULSTER, the most northern province of Ireland, the chief town of which is Londonderry.

ULTERIOR, in geography, is applied to some part of a country or province, which, with regard to the rest of that country, is situated on the farther side of the river, mountain, or other boundary, which divides the country into two parts.

ULTIMUS HÆRES, in Scots law. See LAW, Tit. xxix. 1, 2.

ULTRAMARINE, a beautiful blue colour used by the painters, prepared from lapis lazuli by calcination.

ULTRAMONTANE, something beyond the mountains. The term is principally used in relation to Italy and France, which are separated by the mountains of the Alps.

ULVA, in botany, a genus of the cryptogamia algæ class, consisting of a merely foliaceous substance, formed into long cylindrical tubes. There are 10 species, all natives of Britain.

ULULA, in ornithology. See STRIX.

UMBELLÆ. See BOTANY, p. 637.

UMBELLIFEROUS PLANTS, are such as have their tops branched and spread out like an umbrella.

UMBILICAL, among anatomists, something relating to the umbilicus or navel.

UMBILICUS, the NAVEL, in anatomy. See ANATOMY, p. 257. and MIDWIFERY.

UMBONE, a name used by some for the style or pistil of a flower.

UMPIRE, a third person chosen to decide a controversy left to arbitration.

UNCIA, in general, a Latin term denoting the twelfth part of any thing; particularly the twelfth part of a pound,

called in English an ounce; or the twelfth part of a foot, called an inch.

UNCTION, the act of anointing or rubbing with oil or other fatty matter.

UNCTION, in matters of religion, is used for the character conferred on sacred things, by anointing them with oil. Unctions were very frequent among the Hebrews. They anointed both their kings and high-priests at the ceremony of their inauguration. They also anointed the sacred vessels of the tabernacle and temple, to sanctify and consecrate them to the service of God. The unction of kings is supposed to be a ceremony introduced very late among the Christian princes. It is said, that none of the emperors were ever anointed before Justinian, or Justin. The emperors of Germany took the practice from those of the eastern empire: king Pepin of France was the first who received the unction. In the ancient Christian church, unction always accompanied the ceremonies of baptism and confirmation. Extreme unction, or the anointing persons in the article of death, was also practised by the ancient Christians, in compliance with the precept of St James, chap. v. 14 and 15 verses; and this extreme unction the Romish church has advanced to the dignity of a sacrament. It is administered to none but such as are afflicted with some mortal disease, or are in a decrepit age. It is refused to impenitent persons, as also to criminals. The parts to be anointed are the eyes, the ears, the nostrils, the mouth, the hands, the feet, and the reins. The laity are anointed in the palms of the hands, but priests on the back of it; because the palms of their hands have been already consecrated by ordination. The parts above-mentioned are anointed in the form of a cross. The priest begins anointing the sick person's eyes, saying, "May God, by his holy anointing, pardon you the sins you have committed by the eyes." In like manner he proceeds to the other parts, varying the words according to the parts he anoints.

UNDECAGON, is a regular polygon, of eleven sides.

UNDECEMVIR, a magistrat among the ancient Athenians, who had ten other colleagues or associates joined with him in the same commission. The function of the undecemviri at Athens were much the same as those of the prévôts de marchausse in France: they took care of the apprehending of criminals, secured them in the hands of justice, and when they were condemned, took them again into custody, that the sentence might be executed on them. They were chosen by the tribes, each tribe naming its own; and as the number of the tribes after Callisthenes was but ten, which made ten members, a scribe or notary was added, which made the number eleven.

UNDER *the sea*, in the sea-language. A ship is said to be so when she lies still, or waits for some other ships, with her helm lashed, or tied up a-lee.

UNDERSTANDING. See METAPHYSICS, and LOGIC.

UNDERWALD, a canton of Switzerland, bounded by Switz and Lucern on the north, by Uri on the east. and by another part of Lucern on the west; being about 25 miles long. and as many broad.

UNDERWOOD, is coppice, or any wood that is not accounted timber.

UNDULA-

**UNDULATION**, in physics, a kind of tremulous motion or vibration observable in a liquid, whereby it alternately rises and falls like the waves of the sea.

This undulatory motion, if the liquid be smooth and at rest, is propagated in concentric circles, as most people have observed upon throwing a stone or other matter upon the surface of a stagnant water, or even upon touching the surface of the water lightly with the finger or the like. The reason of these circular undulations is, that by touching the surface with your finger, there is produced a depression of the water in the place of contact. By this depression the subjacent parts are moved successively out of their place, and the other adjacent parts thrust upwards, which lying successively on the descending liquid, follow it; and thus the parts of the liquid are alternately raised and depressed, and that circularly. When a stone is thrown into the liquid, the reciprocal vibrations are more conspicuous.

Undulatory motion is likewise applied to a motion in the air, whereby its parts are agitated after the like manner as waves in the sea; as is supposed to be the case when the string of a musical instrument is struck. This undulatory motion of the air, is supposed the matter or cause of sound.

**UNGUENT**, in medicine and surgery, a topical remedy or composition, chiefly used in the dressing of wounds and ulcers.

**UNGUIS**, in anatomy. See **ANATOMY**, p. 160.

**UNGUIS**, among botanists. See **BOTANY**, p. 637.

**UNGULA**, in geometry, the section of a cylinder cut off by a plane passing obliquely through the plane of the base and part of the cylindric surface.

**UNGULA**, in natural history, the claw or hoof of a quadruped.

**UNICORN**, an animal famous among the ancients, but looked on by the moderns as fabulous.

**UNICORN-FISH**, in ichthyology. See **MONODON**.

**UNIFORM** denotes a thing to be similar, or consistent, either with another thing or with itself, in respect of figure, structure, proportion, and the like; in which sense it stands opposed to dissimil.

**UNIFORMITY**, a similitude, or resemblance, between the parts of a whole: such is that we meet with in figures of many sides, and angles respectively equal, and answerable to each other.

**UNIOLA**, in botany, a genus of the triandria digynia class. The calix consists of many valves; and the spica is oval and carinated. There are four species, none of them natives of Britain.

**UNION**, a junction, coalition, or assemblage of two or more different things in one.

**UNION OF LANDS**, in Scots law. See **LAW**, Tit. x. 20.

**UNION**, or the **UNION**. by way of eminence, is more particularly used to express the act whereby the two separate kingdoms of England and Scotland were incorporated into one, under the title of The kingdom of Great-Britain. This happy union, in vain attempted by king James I. was at length effected in the year 1707, by the general consent of the queen and the estates of each realm. The chief articles of this union are, That the two kingdoms shall be united into one kingdom, by the name of Great-Britain: that they, in consequence thereof, be represented by one parliament, of which sixteen peers and forty-

five commoners are to be elected for Scotland, and have the same privileges with those of England: that the subjects of either nation shall have equal freedom of trade, and be liable to the same custom, and the like laws for public government, &c. The kirk or church of Scotland is confirmed; and the courts of justice are to remain the same as they were before the union, yet subject to regulation, &c. A court of exchequer is also erected in Scotland, to be a court of record, revenue, and judicature, for ever; and barons of the said court are appointed, who shall be the judges there.

**UNISON**; in musick, the effect of two sounds which are equal in degree of tune, or in point of gravity and acuteness.

**UNIT**, or **UNITY**, in arithmetick, the number one, or one single individual part of discrete quantity.

**UNITED NETHERLANDS** consist of the provinces of Holland, Zealand, Friesland Groning, Overysse, Gelderland, with Zutphen and Utrecht; these are bounded by the German sea on the north and west; by the circle of Westphalia, on the east; and by Flanders, Brabant, and the duchy of Cleves. on the south: lying between 3° 20' and 7° 30' east longitude, and between 51° 35' and 52° 40' north latitude; being about fifty miles long, and as many broad including the Zuyder-sea, which takes up a considerable space between these limits.

**UNITY**, in poetry. In the drama there are three unities to be observed, *viz.* the unity of action, that of time, and that of place. In the epic poem, the great, and almost only unity, is that of the action. Some regard indeed ought to be had to that of time; that of place there is no room for. The unity of character is not reckoned among the unities. See **COMPOSITION**.

**UNIVERSAL**, something that is common to many things, or it is one thing belonging to many or all things.

**UNIVERSE**, a collective name, signifying the whole world, or the assemblage of heaven and earth, with all things therein. See **ASTRONOMY**, and **GEOGRAPHY**.

**UNIVERSITY**, a collective term, applied to an assemblage of several colleges, established in a city, wherein are professors in the several sciences, appointed to teach them to students, and where degrees or certificates of study in the divers faculties are taken up.

In each university four faculties are usually taught, theology, medicine, law, and the arts and sciences.

They are called universities, or universal schools, by reason the four faculties are supposed to take in the whole compass of study.

Universities had their first rise in the XIIth and XIIIth centuries. Those of Paris and Bologna pretend to be the first that were set on foot; but they were on a different footing from the universities among us.

The universities of Oxford and Cambridge seem entitled to greatest antiquity of any in the world; and Baliol and Merton colleges in Oxford, and St Peter's in Cambridge, all made colleges in the XIIIth century, may be said to be the first regular endowments of this kind in Europe.

The universities of Scotland are four, *viz.* those of St. Andrews, Aberdeen, Edinburgh, and Glasgow. See **EDINBURGH**. &c.

**UNIVOCAL**, in the schools, is applied to two or more names, or terms that have but one signification; in opposition to equivocal,

- equivocal, which is where one term has two or more significations.
- UNLAWFUL**, illegal, something prohibited by, or contrary to the terms of law, either divine or human.
- UNMOOR**, a term used at sea. When a vessel which was riding at anchor, weighs the same, or gets it up, in order to sail, they say she is unmooring.
- VOCABULARY**, in grammar, denotes the collection of the words of a language, with their significations, otherwise called a dictionary, lexicon, or nomenclature. See **DICTIONARY**.
- A vocabulary is properly a lesser kind of dictionary, which does not enter so minutely into the origins and different acceptations of words.
- VOCAL**, something that relates to the voice or speech; thus vocal music is that set to words, especially verses, and to be performed by the voice; in contradistinction to instrumental music, composed only for instruments, without singing.
- VOCATIVE**, in grammar, the fifth state or case of nouns. When we name the person we are speaking to, or address ourselves to the thing we are speaking of, as if it were a person, the noun or name requires a new relation, which the Latins and Greeks express by a new termination, called the vocative; as, from *dominus*, a lord, is formed the vocative *domine*, O lord.
- VOICE**, a sound produced in the throat and mouth of an animal, by an apparatus of instruments for that purpose. Voices are either articulate or inarticulate. Articulate voices are those whereof several conspire together to form some assemblage or little system of sounds; such are the voices expressing the letters of an alphabet, numbers of which joined together form words. Inarticulate voices are such as are not organized, or assembled into words; such is the barking of dogs, the braying of asses, the hissing of serpents, the singing of birds, &c.
- The formation of the human voice, with all the varieties thereof observed in speech, music, &c. makes a very curious article of inquiry; and the apparatus and organization of the parts administering thereto, is something exceedingly surprising. Those parts are the trachea or wind pipe, through which the air passes, and repasses into the lungs; the larynx, which is a short cylindrical canal at the head of the trachea; and the glottis, which is a little oval cleft or chink left between two semicircular membranes stretched horizontally within the larynx; which membranes, though capable of joining close together, do generally leave an interval either greater or less between them called the glottis. A particular description of each part may be seen in *Anatomy*, Part IV.
- VOICE**, in grammar, a circumstance in verbs, whereby they come to be considered as either active or passive; *i. e.* either expressing an action impressed on another subject, as, *I beat*; or receiving it from another, as *I am beaten*. See **GRAMMAR**, p. 738.
- VOICE**, in matters of election, denotes a vote or suffrage.
- VOIDED**, in heraldry, is understood of an ordinary whose inner or middle part is cut out, leaving nothing but its edges to shew its form, so that the field appears through it. Hence it is needless to express the colour or metal of the voided part, because it must of course be that of the field.
- VOIDER**, in heraldry, one of the ordinaries whose figure is much like that of a flask or flaunch, only that it doth not bend so much. See *Plate CXLVII. fig. 24.*
- VOL**, among heralds, signifies the two wings of a fowl joined together, borne in armory, as being the whole that makes the flight. Accordingly, a demi-vol is a single wing.
- VOLA**, the palm or inside of the hand, comprehended between the fingers and the wrist.
- VOLANT**, in heraldry, is when a bird in a coat of arms is drawn flying, or having its wings spread out.
- VOLATILE**, in physics, is commonly used to denote a mixed body whose integral parts are easily dissipated by fire or heat; but is more properly used for bodies whose elements or first component parts are easily separated from each other, and dispersed in air. See **CHEMISTRY**.
- VOLATILISATION**, the act of rendering fixed bodies volatile, or of resolving them by fire into a fine subtle vapour or spirit, which easily dissipates and flies away. All bodies, even the most fixed, as gold, may be volatilized; either of themselves, or with the admixture of some volatile substance, or spirit, by distillation or sublimation.
- VOLERY**, a great bird-cage, so large that the birds have room to fly up and down in it.
- VOLHINIA**, or **VOLONIA** a province of Poland, bounded by Polesia, on the north; by the lower Volhinia, or Ukrain, in the territories of Russia, on the east; by Podolia, on the south; and by the province of Red Russia, on the west.
- VOLITION**, the act of willing. See **METAPHYSICS**.
- VOLKAMERIA**, in botany, a genus of the didynamia angiosperma class. The calix consists of five segments; and the berry contains two bilocular seeds. There are two species, none of them native of Britain.
- VOLLEY**, a military salute, made by discharging a great number of fire arms at the same time.
- VOLO**, in Roman antiquity, an appellation given to the slaves, who, during the second Punic war, offered themselves to serve in the army.
- VOLT**, in the manege, a round or circular tread; and hence by the phrase, to make volts, is understood a gate of two treads, made by a horse going sideways round a center, in such a manner, that these two treads make parallel tracts, one larger made by the fore-feet, and another smaller made by the hind feet, the croup approaching to wards the centre, and the shoulders bearing outwards.
- VOLUME**, in matters of literature, a book, or writing, of a just bulk to be bound by itself. The name is derived from the Latin *volvere*, to roll up; the ancient manner of making up books being in rolls of bark or parchment. See **Book**.
- VOLUNTARY**, in music, a piece played by a musician extempore, according to his fancy. This is often used before he begins to set himself to play any particular composition, to try the instrument, and to lead him into the key of the piece he intends to perform.
- VOLUNTEERS**, in the military art, persons who of their own accord, and at their own expence, serve in the army.
- VOLUTA**, in natural history, a genus of insects belonging to the order of vermes testacea. It is an animal of the snail kind, with an unilocular spiral shell, of which there are 46 species, distinguished by peculiarities in their shells.
- VOLUTE**, in architecture, a kind of spiral scroll, used in the

- the Ionic and Composite capitals, whereof it makes the principal characteristic and ornament. See ARCHITECTURE, p. 352.
- VOLVULUS**, in medicine, a name which some authors give to the iliac passion. See MEDICINE, p. 114.
- VOMIR**, in anatomy. See ANATOMY, p. 163.
- VOMICA**, in medicine, is commonly taken for a suppurated imposthume, or an abscess with a suppuration. See MEDICINE, p. 104.
- Nux Vomica**, in pharmacy, a flat compressed round fruit, of the breadth of a shilling, or somewhat more, and of about the thickness of a crown-piece.
- It is the nucleus of a fruit of an East-Indian tree, the wood of which is the lignum colubrinum of the shops.
- Some have prescribed small doses of the nux vomica as a specific against a gonorrhœa, and others against quartan agues. But we have so many good and safe medicines for all these purposes, that there seems no occasion for our having recourse to such as these, which shew so many signs of mischief.
- VOMIT**, in pharmacy. See EMETIC.
- VOMITING**, in medicine, a retrograde spasmodic motion of the muscular fibres of the œsophagus, stomach, and intestines. attended with strong convulsions of the muscles of the abdomen and diaphragm, which, when gentle, create a nausea; when violent, a vomiting. See MEDICINE, p. 115.
- VOORN**, one of the islands of Holland, bounded by the river Maes, which divides it from the continent and the island of IJsemunde, on the north; by the sea called the Bies-bosch, on the east; by another branch of the Maes, which divides it from the islands of Goree and Overflackee, on the south; and by the German sea, on the west; being about twenty-four miles long, and five broad.
- VORTEX**, in meteorology, a whirlwind, or sudden, rapid, and violent motion of the air in gyres, or circles.
- Vortex is also used for an eddy or whirlpool; or a body of water, in certain seas or rivers, which runs rapidly around, forming a sort of cavity in the middle.
- VORTEX** in the Cartesian philosophy, is a system or collection of particles of matter moving the same way, and round the same axis.
- Such vortices are the grand machines, whereby those philosophers solve most of the motions and other phenomena of the heavenly bodies. Accordingly, the doctrine of these vortices make a great part of the Cartesian philosophy.
- VOTE**, the suffrage or resolve of each of the members of an assembly, where any affair is to be carried by a majority; but more particularly used for the resolves of the members of either house of parliament.
- VOTIVE MEDALS**, those on which are expressed the vows of the people for the emperors or empresses. See MEDAL.
- VOW**, a solemn and religious promise, or oath. See OATH.
- The use of vows is found in most religions. They make up a considerable part of the pagan worship, being made either in consequence of some deliverance, under some pressing necessity, or for the success of some enterprise. Among the Jews all vows were to be voluntary, and made by persons wholly in their own power; and if such person made a vow, in any thing lawful and possible, he was obliged to fulfil it. If he appointed no particular time for accomplishing his vow, he was bound to do it instantly, lest by delay he should prove less able, or be unwilling, to execute his promise. Among the Romanists, a person is constituted a religious by taking three vows, that of poverty, chastity, and obedience.
- VOWS**, among the Romans, signified sacrifices, offerings, presents, and prayers made for the Cæsars and emperors, particularly for their prosperity and the continuance of their empire. These were at first made every five years, then every fifteen, and afterwards every twenty, and were called quinquennialia, decennialia, and vincennialia.
- VOWEL**, in grammar, a letter which affords a complete sound of itself, or a letter so simple as only to need a bare opening of the mouth to make it heard, and to form a distinct voice.
- The vowels are six in number, *viz.* A, E, I, O, U, Y, and are called vowels, in contradistinction to certain other letters, which, depending on a particular application of some part of the mouth, as the teeth, lips or palate, can make no perfect sound without an opening of the mouth, that is, without the addition of a vowel, and are therefore called consonants.
- UPHOLSTER**, **UPHOLSTERER**, or **UPHOLDER**, a tradesman that makes beds, and all sorts of furniture thereunto belonging, &c.
- UPLAND**, denotes high ground, or, as some call it, terra firma, by which it stands opposed to such as is moorish, marshy, or low.
- UPLAND**, a province of Sweden, bounded by the province of Gestricia on the north-west, by the Baltic sea on the north-east and south-east, and by Sunderland and Weismania on the south and west.
- UPPINGHAM**, a market-town of England, in the county of Rutland, situated six miles south of Okeham.
- UPRIGHT**, in heraldry, is used in respect of shell-fishes, as crevices, &c. when standing erect in a coat. Inasmuch as they want fins, they cannot, according to Guillim, be properly said to be hauriant, that being a term appropriated to scaly fishes.
- UPSAL**, a city once the capital of the province of Upland, and of all Sweden, being the only archbishop's see in Scandinavia, and an university; situated in E. long. 17° 20', N. lat. 60°.
- UPTON**, a market-town of Worcestershire, nine miles south of Worcester.
- UPUPA**, in ornithology, a genus belonging to the order of picæ. The beak is arcuated, convex, and somewhat blunt; the tongue is obtuse, entire, triangular, and very short; and the feet are fitted for walking. There are two species, both natives of India.
- URACHUS**, a membranous canal in the fœtus of quadrupeds in general, of a pyramidal figure, extended immediately from the fundus of the bladder to the navel; and after passing through this, it is by degrees enlarged, and makes its way into the allantois at right-angles each way, or nearly so, and conveys the urine from the bladder into the cavity of this membrane.
- URANBURG**, or **URANIBURG**, a castle of Denmark, situated on the little island of Huen, in the Sound, sixteen miles north-east of Copenhagen. Here was the celebrated observatory built by that noble Dane Tycho Brahe, and furnished with instruments for observing the course and motions of the heavenly bodies.

**URANOSCOPIUS**, in ichthyology, a genus belonging to the order of jugulares. The head is large, rough, and depressed, the upper jaw being shorter than the under one; there are five dentated rays in the membrane of the gills; and the anus is in the middle of the body. There is but one species, found in the Mediterranean sea.

**URBINO**, a province of Italy, in the pope's territory, bounded by Romania and the gulph of Venice on the north and east, by the marquise of Ancona on the south, and by Tuscany on the west, being seventy miles long, and from twenty to fifty broad.

Urbino is also the capital of this province.

**URDE'**, or **URDE'E**, in heraldry. A cross urde seems to be the same with what we otherwise call chleche, or chleché. See **CHLECHE**.

**URENA**, in botany, a genus of the monadelphia polyandria class. The calix is double, the exterior one consisting of five segments; the capsule has five cells containing one seed. There are three species, all natives of China.

**URETERS**, in anatomy. See **ANATOMY**, p. 268.

**URETHRA**, in anatomy. See **ANATOMY**, p. 272.

**URGEL**, a town of Spain, in the province of Catalonia, capital of the territory of Urgel, situated on the river Segra, seventy-five miles north of Barcelona.

**URI**, one of the cantons of Switzerland; bounded by that of Switz, on the north; by Glaris and the Grisons, on the east; by Underwald, on the south; and by the Canton of Bern, on the west.

**URIM** and **THUMMIM**, among the ancient Hebrews, a certain oracular manner of consulting God, which was done by the high priest dressed in his robes, and having on his pectoral or breast-plate.

Various have been the sentiments of commentators concerning the urim and thummim. Josephus, and several others, maintain, that it meant the precious stones set in the high priest's breast-plate, which by extraordinary lustre made known the will of God to those who consulted him. Spencer believes that the urim and thummim were two little golden figures shut up in the pectoral as in a purse, which gave responses with an articulate voice. In short, there are as many opinions concerning the urim and thummim as there are particular authors that wrote about them. The safest opinion, according to Broughton, seems to be, that the words urim and thummim signify some divine virtue and power annexed to the breast-plate of the high priest, by which an oraculous answer was obtained from God when he was consulted by the high-priest; and that this was called urim and thummim to express the clearness and perfection which these oracular answers always carried with them; for urim signifies light, and thummim perfection; these answers not being imperfect and ambiguous, like the heathen oracles, but clear and evident. The use made of the urim and thummim was to consult God in difficult cases relating to the whole state of Israel; and sometimes in cases relating to the king, the sanhedrim, the general of the army, or some other great personage.

**URINAL**, in medicine, a vessel fit to receive and hold urine, and used accordingly for the convenience of sick persons. It is usually of glass, and crooked; and sometimes it is filled with milk, to assuage the pain of the gravel.

**URINAL**, in chemistry, is an oblong glass vessel, closed for making solutions, and so called from its resemblance to the glasses in which urine is set to settle for the inspection of the physician.

**URINE**, a serous and saline fluid, of a citron-colour, separated from the blood, and carried by the emulgent arteries to the kidneys, from whence it descends to the bladder by the ureters, and is from time to time emitted thence by the canal of the urethra. See **ANATOMY**, p. 268. For the analysis of urine, see **CHEMISTRY**, p. 177.

**URN**, a kind of vase, of a roundish form, but biggest in the middle, like the common pitchers, now seldom used but in the way of ornament over chimney-pieces, in buffets, &c. The great use of urns among the ancients, was to preserve the ashes of the dead after they were burnt; for which reason they were called cineraria, and runæ cinerariæ, and were placed sometimes under the tomb-stone whereon the epitaph was cut; and sometimes in vaults in their own houses. Urns were also used at their sacrifices to put liquid things in.

**UROGALLUS**, in ornithology. See **TETRAO**.

**URSA**, in astronomy. See **ASTRONOMY**, p. 487.

**URSULINES**, in church-history, an order of nuns, founded originally by St Angela of Brescia, in the year fifteen hundred thirty seven, and so called from St Ursula, to whom they were dedicated. They observe the rules of St Augustine, and are chiefly noted for taking on them the education and instruction of young maids: their monasteries are a kind of schools where young ladies of the best families receive their education.

**URSUS**, in zoology, a genus of quadrupeds belonging to the order of feræ. There are six foreteeth in the upper jaw alternately hallow on the inside, and six in the under jaw, the two lateral ones being labated; the dog-teeth are solitary and conical; the grinders are five or six; the tongue is smooth; the eyes are furnished with a nictitating membrane; the nose is prominent; and there is a crooked bone in the penis. There are four species, viz.

1. The arctas, or white bear, with an abrupt tail. He is a native of the northern parts of Europe, and feeds upon berries, insects, and the bodies of dead cattle. He is naturally a lazy animal; but when enraged, he becomes agile and furious, standing erect and fighting with his forefeet. When lying, he constantly licks his paws. The female admits the male about the end of October, and she brings forth in 112 days. He never attacks a man, unless he be provoked. 2. The melas, has the tail of an uniform colour; the body is ash-coloured above and black below, with a longitudinal black belt across the eyes and ears. He is likewise a native of Europe, and dwells in woods and the clefts of rocks. He feeds upon eggs, insects, the leaves of the lathyrus, &c. In the night he preys upon rabbits, &c. and seldom appears in the day. He shuts himself up in a den dug in the earth during the winter, and sucks a pellicle or bladder situate above the anus. 3. The lator, has an annular tail, and a black belt across the eyes. He is found about the sea-shores of America. He feeds upon eggs, fowls, snails, &c. 4. The luscus, has a long tail; and the body is iron coloured. He is a native of Hudson's bay.

**URTICA** in botany, a genus of the monœcia tetrandria class. The calix of the male consists of four leaves, and that

that of the female of two valves ; neither of them have any corolla; the male has a cup-shaped nectarium, and the female bears one smooth seed. The species are 18, three of them natives of Britain, *viz.* the pilasfera, or Roman nettle; the arens, or lesser nettle; and the dioica, or common nettle.

**USANCE**, in commerce, is a determinate time fixed for the payment of bills of exchange, reckoned either from the day of the bills being accepted, or from the day of their date; and thus called because regulated by the usage and custom of the places whereon they are drawn.

**USE**, in law, the profit or benefit of lands and tenements; or a trust and confidence reposed in a person for the holding of lands, &c. that he to whose use the trust is made shall receive the profits.

**USEDOM**, an island of Pomerania, in Germany, situated at the mouth of the river Oder, in the Baltic sea: subject to the king of Prussia.

**USHANT**, an island of France, fifteen miles west of the coast of Britany, at the entrance of the British channel.

**USHER**, an officer, or servant, who has the care and direction of the door of a court hall, chamber, or the like.

**USHER** of the black rod, the eldest of the gentlemen ushers, daily waiters at court, whose duty is to bear the rod before the king at the feast of St George, and other solemnities.

**USK**, a river of Wales, which rises on the west of Brecknockshire, and runs south east through that country and Monmouthshire, falling into the mouth of the Severn.

**USQUEBAUGH**, a strong compound liquor, chiefly taken by way of dram.

There are several different methods of making this liquor; but the following is esteemed one of the best: To two gallons of brandy, or other spirits, put a pound of Spanish-liquorice, half a pound of raisins of the sun, four ounces of currants, and three of sliced dates; the tops of baum, mint, savory, thyme, and the tops of the flowers of rosemary, of each two ounces; cinnamon and mace, well bruised, nutmegs, aniseeds, and coriander-seeds, bruised likewise, of each four ounces; of citron, or lemon, and orange-peel, scraped, of each an ounce: let all these infuse forty-eight hours in a warm place, often shaking them together: then let them stand in a cool place for a week: after which the clear liquor is to be decanted off, and to it is to be put an equal quantity of neat white port, and a gallon of canary; after which it is to be sweetened with a sufficient quantity of double-refined sugar.

**USTION**, in pharmacy, the preparing of certain substances by burning them.

**USTULATION**, a word used by pharmaceutic writers, to express the roasting or torrefying of humid or moist substances over a gentle fire, so as to render them fit for powdering.

**USUCAPTION**, in the civil law, is an acquisition of the property of a thing, by a possession and enjoyment thereof for a certain term of years prescribed by law.

**USUFRUIT**, in the civil law the use or enjoyment of any lands or tenements; or the right of receiving the fruits and profits of an inheritance, or other thing, without a power of alienating or changing the property thereof.

**USURER**, a person charged with a habit or act of usury. See **USURY**.

**USURIOUS CONTRACT**, is any bargain or contract whereby a man is obliged to pay more interest for money than the statute allows.

**USURPATION**, in law, is an injurious using or enjoyment of a thing for continuance of time, that belongs of right to another.

**USURY**, in the general, denotes a gain or profit which a person makes of his money, by lending the same; or it is an increase of the principal, exacted for the loan thereof; or the price a borrower gives for the use of a sum credited to him by the lender, called also interest.

The word usury is generally taken in an evil sense, *viz.* for an unlawful profit which a person makes of his money; in which sense it is, that usury is forbidden by the civil and ecclesiastical, and even by the law of nature. See **LAW**, Tit. xxxiii. 37.

**UTERINE**, something belonging to the uterus or womb of a woman.

*Brother or Sister* **UTERINE**, in Scots law. See **LAW**, Tit. xxvii. 3.

**UTERUS**, in anatomy. See **ANATOMY**, p. 274.

**UTILE**, a Latin term, signifying profitable or useful; in which sense it is sometimes used by English writers.

**UTOXETER**, a market-town of Staffordshire, twelve miles south-east of Stafford.

**UTRECHT**, the capital of a province of the same name, in the united Netherlands, situated twenty-three miles south-east of Amsterdam.

**UTRICULARIA**, in botany, a genus of the diandria monogynia class. The corolla is ringent and calcarated; the calix consists of two equal leaves; and the capsule of one cell. There are five species, two of them natives of Britain, *viz.* the vulgaris, or common hooded milfoil; and the minor, or lesser hooded milfoil.

**UVA URSI**, in botany. See **VACCINIUM**.

**UVEA**, in anatomy. See **ANATOMY**, p. 289.

**VULCANO**, or **VOLCANO**, in natural history, a burning mountain, or one that vomits forth fire, flame, ashes, cinders, &c.

As to the cause of vulcanos, it is found by experience, that there are several inflammable bodies, which, being mixed together in due proportion, will kindle into flame by fermentation alone, without the help of any fiery particles. Thus M. Lemery having covered up in the earth about fifty pounds of a mixture, composed of equal parts of sulphur and filings of iron, tempered with water; after eight or nine hours time, the earth where it lay vomited up flames. From this experiment we see the true cause of the fire of Ætna, Vesuvius, and other burning mountains, which probably are made up of sulphur and some other matter proper to ferment with it, and take fire.

**VULGATE**, a very ancient Latin translation of the Bible, and the only one the church of Rome acknowledges authentic. See **BIBLE**.

**VULNERARY**, in medicine, an epithet given to remedies proper for the cure of wounds and ulcers.

**VULPES**, the Fox. See **CANIS**.

**VULTUR**, a genus of birds belonging to the order of accipitres. The beak is straight, and crooked at the point; the head has no feathers, on the forepart being only naked skin; and the tongue is bifid. There are eight species,

cies distinguished principally by their colour and situation of caruncles.

**VULVA**, in anatomy. See *ANATOMY*, p. 275

**UVULA**, in anatomy. See *ANATOMY*, p. 303.

**UVULARIA**, in botany, a genus of the hexandria monogynia class. The corolla consists of six straight petals; the nectarii are little pits at the base of each petal; and the filaments are very short. There are

three species, none of them natives of Britain. **UXBRIDGE**, a market-town of Middlesex, situated on the river Colne, fifteen miles west of London. **UZBECK, TARTARY**, a large country of Asia, bounded by Calmuc Tartary on the north, by Tibet on the east, by India and Persia on the south, and by a great desert, which separates it from the Caspian sea, on the west.



## W.

### W A G

**W****ÄAG**, a river of Hungary, which rises in the Carpathian mountains, on the confines of Poland, and running first from east to west, then turns south, and passing by Leopoldstadt, falls into the Danube, opposite to the island of Schut.

**W****AAL**, a river of the United Netherlands, being one of the branches of the Rhine, which runs from east to west, through the Betu, in the province of Guelderland, passing by Nimeguen, Tiel, Bommel, and Gorcum, and continuing its course eastward, unites its waters with the Maes, and, passing by Dort, falls into the German sea below the Briel.

**W****ADD**, or **W****ADDING**, is a stopple of paper, hay, straw, or the like, forced into a gun upon the powder, to keep it close in the chamber; or to put up close to the shot, to keep it from rolling out.

**W****ADSET**, in Scots law. See *LAW*, Tit. xv. 1, &c.

**W****AFT**. To waft a ship, is to convoy her safe, as men of war do merchant ships. To make a waft, is to hang out some coat, sea gown, or the like, on the main shrouds of the ship, as a signal for people to come aboard, and signifying that the ship is in great distress.

**W****AFERS**, or *Sealing Waffers*, are made thus: take very fine flower, mix it with glair of eggs, isinglafs, and a little yeast; mingle the materials; beat them well together; spread the batter, being made thin with gum-water, on even tin plates; and dry them in a stove; then cut them out for use.

You may make them of what colour you please, by tinging the paste with brazil or vermilion for red; indigo or verditer, &c. for blue; saffron, turmeric, or gamboge, &c. for yellow.

**W****AGGON**, a wheel-carriage, of which there are various forms, accommodated to the different uses they are intended for. The common waggon consists of the shafts or rads, being the two pieces which the hind horse bears up; the welds; the flotes, or cross pieces, which hold the shafts together; the bolster, being that part on which the fore wheels and the axle-tree turn in wheeling the waggon across the road; the chest or body of the waggon, having the staves or rails fixed thereon; the bales, or hoops, which compose the top; the tilt, the place covered with cloth, at the end of the waggon. See *Mechanics*, p. 50.

### W A L

**W****AGRIA**, the eastern division of the duchy of Holstein, in the circle of Lower Saxony, in Germany, bounded by the Baltic sea on the north, east, and south.

**W****AGTAIL**, in ornithology. See *MOTACILLA*.

**W****AIF**, in law, a term applied to such goods as a thief having feloniously stolen, on his being closely pursued are waved or left by the felon, which become forfeited to the king, or lord of the manor.

**W****AIGRATS STRAITS**, situated between Nova Zembla and Russia, through which the Dutch sailed to the north, as high as 75°, in order to discover a north-east passage to China and the East Indies.

**W****AINSCOT**, in building, the timber work that serves to line the walls of a room, being usually made in pannels, and painted, to serve instead of hangings.

**W****AKE of a ship**, is the smooth water altern when she is under sail: this shews the way she has gone in the sea, whereby the mariners judge what way she makes.

**W****AKE**, is the eve-feast of the dedication of churches, which is kept with feasting and rural diversions.

**W****AKEFIELD**, a market-town in the west-riding of Yorkshire, situated on the river Caulder, twenty-four miles south-west of York.

*Action of WAKENING*, in Scots law. See *LAW*, Tit. xxx. 26

**W****ALACHIA**, a province of Turkey in Europe, bounded by the Irongate mountains, which separate it from Transylvania, on the north-west; by Moldavia, on the north-east; by the river Danube, which separates it from the province of Bulgaria, on the south-east; and the same river separates it from the province of Servia on the south-west. It is two hundred miles long, and one hundred broad.

**W****ALCOURT**, a town of the bishopric of Liege, situated on the confines of Namur, eighty miles south of Charleroy.

**W****ALDEC**, a town of Germany, in the circle of the Upper Rhine, and landgraviate of Hesse Cassel, twenty miles south-west of Hesse Cassel city.

**W****ALDEN**, a market-town of Essex, situated twenty-five miles north-west of Chelmsford.

**W****ALE**, or **W****ALES**, in a ship, those outermost timbers in a ship's side, on which the sailors set their feet in climbing up. They are reckoned from the water, and are called her first, second, and third wale, or bend.

**W****ALE-**

**WALE-KNOT**, a round knot or knob made with three strands of a rope, so that it cannot slip, by which the tacks, top-sail sheets, and stoppers are made fast, as also some other ropes.

**WALE-REARED**, on board a ship, a name the seamen give to a ship, which, after she comes to her bearing, is built strait up: this way of building, though it does not look well, nor is, as the seamen term it, ship-shapen; yet it has this advantage, that a ship is thereby more roomy within board, and becomes thereby a wholesome ship at sea, especially if her bearing be well laid out.

**WALES**, a principality in the west of England, comprehending 12 counties, bounded by Cheshire, Shropshire, Herefordshire, and Monmouthshire, on the east, and surrounded by the sea called the Irish channel, on the north, west, and south.

*New WALES*, the south-west coast of Hudson's Bay, in North America, so called; now possessed by the English Hudson's Bay company.

**WALL** is architecture, the principal part of a building, as serving both to inclose it, and support the roof, floors, &c.

Walls are distinguished into various kinds, from the matter whereof they consist, as plastered or mud-walls, brick-walls, stone-walls, flint or boulder walls, and boarded walls. See **ARCHITECTURE**.

**WALLINGFORD**, a borough-town of Berkshire, situated on the river Thames, twelve miles north of Reading.

**WALLOONS**, the inhabitants of a considerable part of the Spanish Netherlands, viz those of Artois, Hainault, Namur, Luxemburgh, and part of Flanders and Brabant.

The Walloon language is said to have been that of the ancient Gauls or Celts.

**WALRUS**, in zoology. See **PHOCA**.

**WALNUT TREE** in botany. See **JUGLANS**.

**WALSALL**, a market-town of Staffordshire, thirteen miles south of Stafford.

**WALSHAM** a market-town of Norfolk, eleven miles north of Norwich.

**WALSINGHAM**, a market town of Norfolk, eighteen miles north-west of Norwich.

**WALTHAM**, a market town of Leicestershire, sixteen miles north east of Leicester.

**WALTHERIA**, in botany, a genus of the monadelphia pentandria class.

**WAPENTAKE**, (from the Saxon) the same with what we call a hundred, and more especially used in the northern counties beyond the river Trent. There have been several conjectures as to the original of the word; one of which is, that anciently milters were made of the armour and weapons of the inhabitants of every hundred; and from those that could not find sufficient pledges of their good abearing, their weapons were taken away, and given to others; whence, it is said, this word is derived. See **HUNDRED**.

**WAR**, a contest or difference between princes, states, or large bodies of people; which not being determined by the ordinary measures of equity and justice, is referred to the decision of the sword.

**WARD**, a word of divers significations: thus, a ward in London, is a part of the city committed to the special charge of one of the aldermen of the city. There are twenty-six wards in London, which are as hundreds, and

the parishes thereof as towns. A forest is also divided into wards, and so are most of our hospitals.

**WARD-HOLDING**, in Scots law. See **LAW**, Tit. xi. 1.

**WARD-HOOK**, or **WADD-HOOK**, in gunnery, a rod or staff with an iron end turned serpent-wise, or like a screw, to draw the wadding out of a gun when it is to be unloaded. See **WADD**.

**WARDEN**, or **GUARDIAN**, one who has the charge or keeping of any person, or thing, by office. See **GUARDIAN**.

Such is the warden of the fleet, the keeper of the fleet-prison; who has the charge of the prisoners there, especially such as are committed from the court of chancery for contempt.

*Church* **WARDENS**. See **CHURCH**.

**WARDHUIS**, a port of Norwegian Lapland, 120 miles south-east of the north-cape: E. long. 28°; and N. lat. 71°.

**WARDMOTE**, in London, is a court so called; which is kept in every ward of the city, answering to the curiata comitia in ancient Rome.

**WARDROBE**, a closet, or little room adjoining to a bed-chamber, serving to dispose and keep a person's apparel in; or, for a servant to lodge in, to be at hand to wait, &c.

Wardrobe, in a prince's court, is an apartment where-in his robes, wearing apparel, and other necessaries, are preserved under the care and direction of proper officers; as the master of the wardrobe, clerk, &c. of the wardrobe.

**WARE**, a market-town of Hertfordshire, under the meridian of London, and twenty miles north of that city.

**WAREHAM**, a borough of Dorsetshire, seventeen miles east of Dorchester.

**WARMINSTER**, a market-town of Wiltshire, seventeen miles north-west of Salisbury.

**WARN**, in law, is to summon a person to appear in a court of justice.

**WARNING of Tenants**, in Scots law. See **LAW**, Tit. xiii. 16.

**WARP**, in the manufactures, is the threads, whether of silk, wool, linen, hemp, &c. that are extended length-wise on the weaver's loom; and a cross which the workman by means of his shuttle passes the threads of the woof, to form a cloth, ribband, stuffian, or other matter.

**WARRANTICE**, in Scots law. See **LAW**, Tit. x. 11.

**WARRANT**, an act, instrument, or obligation, whereby a person authorises another to do something which he otherwise had not a right to do.

**WARRANTY**, a promise or covenant by deed, made by the bargainer for himself and his heirs, to warrant and secure the bargainee and his heirs against all men for enjoying the thing agreed on between them.

**WARREN**, a franchise, or place privileged either by prescription or grant from the king, to keep beasts and fowl of warren in; as rabbits, hares, partridges, pheasants, &c.

**WARRINGTON**, a market-town of Lancashire, seventeen miles east of Liverpool.

**WARSAW**, the capital of Warfovia, and of the kingdom of Poland: E. long. 21° 5', and N. lat. 52° 15'.

**WARSOVIA**, a province of Poland, bounded by Prussia, on the north; by Polachia, on the east; by the province of Little Poland, on the south; and by that of Great Poland, on the west.

**WART**.

**WART**, in surgery, a little round hard excrescence arising from the flesh like a pea.

**WARWICK**, the capital of Warwickshire, situated on the river Avon, eighty miles north-west of London: W. long.  $1^{\circ} 32'$ , N. lat.  $52^{\circ} 20'$ .

**WASH**, among distillers, the fermentable liquor used by the malt-distillers. See **BREWERY**.

**WASHING**, in painting, is when a design, drawn with a pen or crayon, has some one colour laid over it with a pencil, as Indian ink, bistre, or the like, to make it appear the more natural, by adding the shadow of prominences, aperture, &c. and by imitating the particular matters whereof the thing is supposed to consist.

Thus they wash with a pale red, to imitate brick and tile; with a pale Indian-blue, to imitate water and slate; with green, for trees and meadows; with saffron or

French berries, for gold or brass; and with several colours, for marbles.

**WASHING of Ores**, the purifying an ore of any metal, by means of water, from earths and stones, which would otherwise render it difficult of fusion. See **CHEMISTRY**, p. 130.

**WASP**, in zoology. See **VESPA**.

**WASTE of a Ship**, is that part of her between the main and fore mast.

**WASTE-BOARDS**, are boards sometimes set upon the side of a boat, or other vessel, to keep the sea from breaking into her.

**WATCH**, in the art of war, a number of men posted at any passage, or a company of the guards who go on the patrol.

## W A T C H and C L O C K W O R K.

**A** **CLOCK** is a machine constructed in such a manner, and regulated by such uniform movements, as to measure time and all its subdivisions with great exactness. The same definition comprehends watches of all kinds; and indeed they are both made upon the same principles. We shall therefore give a view of the construction of both these machines under this article.

*Of the Mechanism of Clocks, and how they measure Time.*

**T**HE first figure of Plate CLX is a profile of a clock; P is a weight suspended by a rope that winds about the cylinder or barrel C, which is fixed upon the axis *a a*; the pivots *b b* go into holes made in the plates TS, TS, in which they turn freely. These plates are made of brass or iron, and are connected by means of four pillars ZZ; and the whole together is called the frame.

The weight P, if not restrained, would necessarily turn the barrel C with an uniform accelerated motion, in the same manner as if the weight was falling freely from a height. But the barrel is furnished with a ratchet wheel K K, the right side of whose teeth strikes against the click, which is fixed with a screw to the wheel D D, as represented in fig. 2. so that the action of the weight is communicated to the wheel D D, the teeth of which act upon the teeth of the small wheel *d* which turns upon the pivots *c c*. This communication of the teeth of one wheel with another is called engrènement or pitching; and a small wheel, like *d*, is called a pinion.

The wheel E E is fixed upon the axis of the pinion *d*; and the motion communicated to the wheel D D by the weight is transmitted to the pinion *d*, consequently to the wheel E E, as likewise to the pinion *e*, and wheel FF, which moves the pinion *f*, upon the axis of which the crown or balance wheel G H is fixed. The pivots of the pinion *f* play in holes of the plates L M which are fixed horizontally to the plates T S. In a word, the motion begun by the weight is transmitted from the wheel G H to the palettes I K, which communicates its motion by means of the fork U X riveted on the palettes, to the pendulum A B, which is suspended upon the hook A. The pendulum A B describes, round the point A, an arc of a circle alternately going and re-

turning. If then the pendulum be once put in motion by a push of the hand, the weight of the pendulum at B will make it return upon itself, and it will continue to go alternately backward and forward till the resistance of the air upon the pendulum, and the friction at the point of suspension at A, destroys the original impressed force. But as, at every vibration of the pendulum, the teeth of the balance-wheel G H act so upon the palettes I K, (the pivots upon the axis of these palettes play in two holes of the potence *s t*.) that after one tooth H has communicated motion to the palette K, that tooth escapes; then the opposite tooth G acts upon the palette I, and escapes in the same manner; and thus each tooth of the wheel escapes the palettes I, K, after having communicated their motion to the palettes in such a manner that the pendulum, instead of being stoppt, continues to move.

The wheel E E revolves in an hour; the pivot *c* of this wheel passes through the plate, and is continued to *r*; upon the pivot is a wheel NN with a long socket fastened in the centre; upon the extremity of this socket *r* the minute-hand is fixed. The wheel N N acts upon the wheel O; the pinion of which, *p*, acts upon the wheel *g g*, fixed upon a socket which turns along with the wheel N. This wheel *g g* makes its revolution in 12 hours, upon the barrel of which the hour-hand is fixed.

From the above description it is easy to see, 1. That the weight *p* turns all the wheels, and at the same time continues the motion of the pendulum 2. That the quickness of the motion of the wheels is determined by that of the pendulum. 3. That the wheels point out the parts of time divided by the uniform motion of the pendulum.

When the cord upon which the weight is suspended is entirely run down from off the barrel, it is wound up again by means of a key, which goes on the square end of the arbor at Q. by turning it in a contrary direction from that in which the weight descends. For this purpose, the inclined side of the teeth of the wheel R (fig. 2) removes the click C, so that the ratchet-wheel R turns while the wheel D is at rest: But as soon as the cord is wound up, the click falls in between the teeth of the wheel D and the right side of the teeth again act upon the end of the click, which obliges the

the wheel D to turn along with the barrel; and the spring A keeps the crank between the teeth of the ratchet-wheel R.

We shall now explain how time is measured by the motion of the pendulum; and how the wheel E, upon the axis of which the minute-hand is fixed, makes but one precise revolution in an hour. The vibrations of a pendulum are performed in a shorter or longer time in proportion to the length of the pendulum itself. A pendulum of 3 feet  $8\frac{1}{2}$  French lines in length, makes 3600 vibrations in an hour; *i. e.* each vibration is performed in a second of time, and for that reason it is called a *second pendulum*. But a pendulum of 9 inches  $2\frac{1}{4}$  French lines makes 7200 vibrations in an hour, or two vibrations in a second of time, and is called a *half-second pendulum*. Hence, in constructing a wheel whose revolution must be performed in a given time, the time of the vibrations of the pendulum which regulates its motion must be considered. Supposing, then, that the pendulum AB makes 7200 vibrations in an hour, let us consider how the wheel E shall take up an hour in making one revolution. This entirely depends on the number of teeth in the wheels and pinions. If the balance-wheel consists of 30 teeth, it will turn once in the time that the pendulum makes 60 vibrations: for at every turn of the wheel, the same tooth acts once on the palette I, and once on the palette K, which occasions two separate vibrations in the pendulum; and the wheel having 30 teeth, it occasions twice 30, or 60 vibrations. Consequently, this wheel must perform 120 revolutions in an hour; because 60 vibrations, which it occasions at every revolution, are contained 120 times in 7200, the number of vibrations performed by the pendulum in an hour. Now in order to determine the number of teeth for the wheels E F, and their pinions *e f*, it must be remarked, that one revolution of the wheel E will turn the pinion *e* as many times as the number of teeth in the pinion is contained in the number of teeth in the wheel. Thus, if the wheel E contains 72 teeth, and the pinion *e* 6, the pinion will make twelve revolutions in the time that the wheel makes one; for each tooth of the wheel drives forward a tooth of the pinion, and when the six teeth of the pinion are moved, a complete revolution is performed; but the wheel E has by that time only advanced six teeth, and has still 66 to advance before its revolution be completed, which will occasion 11 more revolutions of the pinion. For the same reason, the wheel F having 60 teeth, and the pinion *f* 6, the pinion will make 10 revolutions while the wheel performs one. Now, the wheel F being turned by the pinion *e*, makes 12 revolutions for one of the wheel E; and the pinion *f* makes ten revolutions for one of the wheel F; consequently, the pinion *f* performs 10 times 12 or 120 revolutions in the time the wheel E performs one. But the wheel G, which is turned by the pinion *f*, occasions 60 vibrations in the pendulum each time it turns round; consequently the wheel G occasions 60 times 120 or 7200 vibrations of the pendulum while the wheel E performs one revolution; but 7200 is the number of vibrations made by the pendulum in an hour, and consequently the wheel E performs but one revolution in an hour; and so of the rest.

From this reasoning, it is easy to discover how a clock may be made to go for any length of time without being wound up: 1. By increasing the number of teeth in the wheels. 2. By diminishing the number of teeth in the pinions. 3. By increasing the length of the cord that sus-

pends the weight; and lastly, by adding to the number of wheels and pinions. But, in proportion as the time is augmented, if the weight continues the same, the force which it communicates to the last wheel GH will be diminished.

It only remains to take notice of the number of teeth in the wheels which turn the hour and minute hands.

The wheel E performs one revolution in an hour; the wheel NN, which is turned by the axis of the wheel E, must likewise make only one revolution in the same time; and the minute-hand is fixed to the barrel of this wheel. The wheel N has 30 teeth, and acts upon the wheel O, which has likewise 30 teeth, and the same diameter; consequently the wheel O takes one hour to a revolution: now the wheel O carries the pinion *p*, which has six teeth, and which acts upon the wheel *qq* of 72 teeth; consequently the pinion *p* makes 12 revolutions while the wheel *qq* makes one, and of course the wheel *qq* takes 12 hours to one revolution; and upon the barrel of this wheel the hour-hand is fixed. We shall conclude with remarking, that all that has been said here concerning the revolutions of the wheels, &c. is equally applicable to watches as to clocks.

#### *Of the Mechanism of a WATCH.*

WATCHES, as well as clocks, are composed of wheels and pinions, and a regulator to direct the quickness or slowness of the wheels, and of a spring which communicates motion to the whole machine. But the regulator and spring of a watch are vastly inferior to the weight and pendulum of a clock, neither of which can be employed in watches. In place of a pendulum, therefore, we are obliged to use a balance (fig. 4.) to regulate the motion of a watch; and of a spring (fig. 6.) which serves in place of a weight, to give motion to the wheels and balance.

The wheels of a watch, like those of a clock, are placed in a frame formed of two plates and four pillars. Fig. 3. represents the inside of a watch, after the plate (fig. 5.) is taken off. A is the barrel which contains the spring (fig. 6.) the chain is rolled about the barrel, with one end of it fixed to the barrel A, and the other to the fusee B.

When a watch is wound up, the chain which was upon the barrel winds about the fusee, and by this means the spring is stretched; for the interior end of the spring is fixed by a hook to the immovable axis, about which the barrel revolves; the exterior end of the spring is fixed to the inside of the barrel, which turns upon an axis. It is therefore easy to perceive how the spring extends itself, and how its elasticity forces the barrel to turn round, and consequently obliges the chain which is upon the fusee to unfold and turn the fusee; the motion of the fusee is communicated to the wheel CC; then, by means of the teeth, to the pinion *c*, which carries the wheel D; then to the pinion *d*, which carries the wheel E; then to the pinion *e*, which carries the wheel F; then to the pinion *f*, upon which is the balance-wheel G, whose pivot runs in the pieces A called a po-tance, and B called the follower, which are fixed on the plate, fig. 5. This plate, of which only a part is represented, is applied to that of (fig. 3.) in such a manner, that the pivots of the wheels enter into holes made in the plate (fig. 3.) Thus the impressed force of the spring is communicated to the wheels; and the pinion *f*, being then connected to the wheel F, obliges it to turn, (fig. 7.) This wheel acts upon the palette of the verge 1. 2, (fig. 4.) the axis of which carries the balance

III. (fig. 4) The pivot I, in the end of the verge, enters into the hole *c* in the potance A (fig. 5.) In this figure the palettes are represented; but the balance is on the other side of the plate, as may be seen in fig. 11. The pivot 3 of the balance enters into a hole of the cock BC, (fig. 10) a perspective view of which is represented in (fig. 12.) Thus the balance turns between the cock and the potance *c*, (fig. 5.) as in a kind of cage. The action of the balance-wheel upon the palettes 1, 2, (fig. 4.) is the same with what we have described with regard to the same wheel in the clock; *i. e.* in a watch the balance wheel obliges the balance to vibrate backwards and forward like a pendulum. At each vibration of the balance a palette allows a tooth of the balance-wheel to escape, so that the quickness of the motion of the wheels is entirely determined by the quickness of the vibrations of the balance, and these vibrations of the balance and motion of the wheels are produced by the action of the spring.

But the quickness or slowness of the vibrations of the balance depend not solely upon the action of the great spring, but chiefly upon the action of the spring *a, b, c*, called the spiral spring, (fig. 14.) situated under the balance H, and represented in perspective (fig. 11.) The exterior end of the spiral is fixed to the pin *a*, (fig. 14.)

This pin is applied near the plate in *a*, (fig. 11.) the interior end of the spiral is fixed by a peg to the centre of the balance. Hence if the balance is turned upon itself, the plates remaining immovable, the spring will extend itself, and make the balance perform one revolution. Now, after the spiral is thus extended, if the balance be left to itself, the elasticity of the spiral will bring back the balance, and in this manner the alternate vibrations of the balance are produced.

In fig. 7 all the wheels above described are represented in such a manner, that you may easily perceive at first sight how the motion is communicated from the barrel to the balance.

In fig. 8. are represented the wheels under the dial-plate by which the hands are moved. The pinion *a* is adjusted to the force of the prolonged pivot of the wheel D, (fig. 7.) and is called a cannon pinion. This wheel revolves in an hour. The end of the axis of the pinion *a*, upon which the minute-hand is fixed, is square; the pinion (fig. 8.) is indented into the wheel *b*, which is carried by the pinion *a*. Fig. 9. is a wheel fixed upon a barrel, into the cavity of which the pinion (*a*) enters, and upon which it turns freely. This wheel, (*d*) revolves in 12 hours, and carries along with it the hour-hand.

## W A T

**WATCHING**, in medicine, is produced by too great a determination of the nervous fluid to the organs of the senses; whereby these organs are prepared to receive, readily, any impressions from external objects, which they propagate to the brain, and furnish the soul with divers occasions of thinking. See **MEDICINE**, p. 157.

**WATER**, in physiology, a simple fluid, and liquid body, reputed the third of the four vulgar elements. See **CHEMISTRY**, p. 67. and **HYDROSTATICS**.

**Holy WATER**, a water prepared every Sunday in the Romish church, with divers prayers, exorcisms, &c. used by the people to cross themselves withal at their entrance to and going out of church; and pretended to have the virtue of washing away venial sins, driving away devils, preserving from thunder, dissolving charms, securing from, or curing diseases, &c. Many of the reformed take the use of holy water to have been borrowed from the lustral water of the ancient Romans.

**WATER ORDEAL**, or **TRIAL**, among our ancestors, was of two kinds, by hot and by cold water. Trial or purgation, by boiling or hot water, was a way of proving crimes, by immersing the body, or the arm, in hot water, with divers religious ceremonies. In the judgment by boiling water, the accused, or he who personated the accused, was obliged to put his naked arm into a caldron full of boiling water, and to draw out a stone thence placed at a greater or less depth, according to the quality of the crime. This done, the arm was wrapped up, and the judge set his seal on the cloth; and at the end of three days they returned to view it: when if it were found without any scald, the accused was declared innocent. The nobles or great personages purged themselves thus by hot water, and the populace by cold water. The trial, or purgation, by cold water, was thus: After certain prayers and other ceremonies, the accused was swaddled or tied

## W A T

up all in a pelatoon or lump, and thus cast into a river, lake, or vessel of cold water; where if he sunk, he was held criminal; if he floated, innocent.

In the Levitical law, we find mention made of water which served to prove whether or no a woman was an adulteress; the formula, as it was performed by the priest, may be seen in the fifth chapter of the book of Numbers.

**WATER**, among jewellers, is properly the colour or lustre of diamonds and pearls. The term, though less properly, is sometimes used for the hue or colour of other stones.

**WATER Beetle**, in zoology. See **DYTISCUS**.

**WATER BORNE**, in the sea-language. A ship is said to be water borne, when she is where there is no more water than will barely bear her from the ground; or when lying even with the ground, she first begins to float or swim.

**WATER COLOURS**, in painting, are such colours as are only diluted and mixed up with gum-water, in contradistinction to oil-colours.

**WATER GANG**, a channel cut to drain a place by carrying off a stream of water.

**WATER LINE of a Ship**, a line which distinguishes that part of her under water from that above, when she is duly laden.

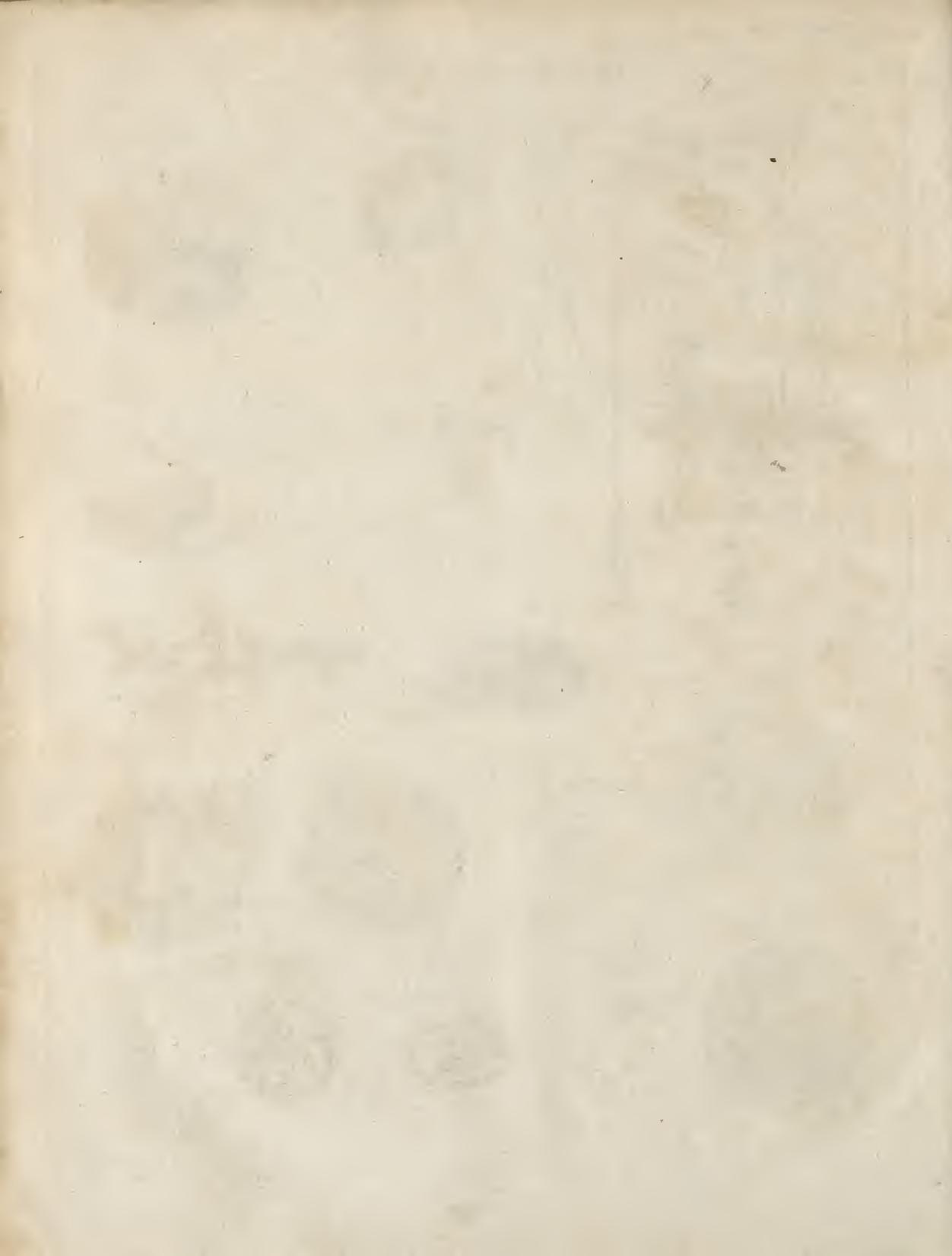
**WATER-MEN**, are such as row in boats, or ply on the river Thames, in the government of whom the lord-mayor of London, and court of aldermen there, had always great power. They still have the appointing of their fares, the taking more than which makes them liable to a fine of 40s. and half a year's imprisonment.

**WATER-SHOOT**, a young sprig which springs out of the root or stock of a tree

**WATER SHOT**, in the sea-language, a sort of riding at anchor, when a ship is moored neither cross the tide, nor right up and down, but quartering betwixt both.

**WATER-TABLE**, in architecture, a sort of ledge left in stone





stone or brick-walls, about eighteen or twenty inches from the ground, from which place the thickness of the wall begins to abate.

**WATER WAY**, in a ship, is a small ledge of timber, lying fore and aft on the deck, close by her sides, to keep the water from running down there.

**WATER-WORKS**, in general, denote all manner of machines moved by, or employed in raising or sustaining water; in which sense, water-mills of all kinds, sluices, aqueducts, &c. may be called water-works. See **HYDRO-STATICS**.

**WATERFORD**, a port-town of Ireland, capital of the county of Waterford, situated on the river Sure, eight miles north of the sea: W. long. 7°, N. lat. 52° 12'.

It is one of the largest cities in Ireland, and has a good foreign trade.

**WATERING**, in the manufactures, is to give a lustre to stuffs, &c. by wetting them lightly with gum-water, and then passing them through the prefs, or calender, whether hot or cold.

The gum water ought to be pure, thin, and clear, otherwise the folds of the stuff will stick together: the operation must also be performed when the water is very hot, that it may penetrate.

**WATLINGTON**, a market-town of Oxfordshire, situated twelve miles south-east of Oxford.

**WATTON**, a market-town of Norfolk, sixteen miles south-west of Norwich.

**WAVE**, in philosophy, a cavity in the surface of water, or other fluid, with an elevation aside thereof.

The waves of the sea are of two kinds, natural and accidental. The natural waves are those which are exactly proportioned in size to the strength of the wind, whose blowing gives origin to them. The accidental waves are those occasioned by the wind's re-acting upon itself by repercussion from hills and mountains, or high shores, and by the washing of the waves themselves, otherwise of the natural kind, against rocks and shoals: all these causes give the waves an elevation, which they can never have in their natural state.

Mr. Boyle has proved, by numerous experiments, that the most violent wind never penetrates deeper than six feet into the water; and it should seem a natural consequence of this, that the water moved by it can only be elevated to the same height of six feet from the level of the surface in a calm: and this six feet of elevation being added to the six of excavation, in the part whence that water so elevated was raised, should give twelve feet for the utmost elevation of a wave. This is a calculation that does great honour to its author: for count Marfigli measured carefully the elevation of the waves near Provence, and found, that, in a very violent tempest, they arose only to seven feet above the natural level of the sea, and this additional foot in height he easily resolved into the accidental shocks of the water against the bottom, which was, in the place he measured them in, not so deep as to be out of the way of affecting the waves; and he allows that the addition of one sixth of the height of a wave, from such a disturbance from the bottom, is a very moderate alteration from what would have been its height in a deep sea; and concludes, that Mr. Boyle's calculation holds perfectly right in deep seas, where the waves are purely natural, and have no accidental causes to render them

larger than their just proportion. In deep water, under the high shores of the same part of France, this author found the natural elevation of the waves to be only five feet; but he found also, that their breaking against rocks, and other accidents to which they were liable in this place, often raised them to eight feet high.

We are not to suppose, from this calculation, that no wave of the sea can rise more than six feet above its natural level in open and deep water; for waves immensely higher than these are formed, in violent tempests, in the great seas. These, however, are not to be accounted waves in their natural state; but they are single waves formed of many others: for in these wide plains of water, when one wave is raised by the wind, and would elevate itself up to the exact height of six feet, and no more, the motion of the water is so great, and the succession of the waves so quick, that, during the time this is rising, it receives into it several other waves, each of which would have been at the same height with itself; these run into the first wave, one after another, as it is rising; by this means its rise is continued much longer than it naturally would have been, and it becomes terribly great. A number of these complex waves arising together, and being continued in a long succession by the continuation of the storm, make the waves so dangerous to ships, which the sailors in their phrase call mountains-high.

**WAVE-OFFERING**, in Jewish antiquity, a sacrifice offered by agitation, or waving, towards the four cardinal points of the compass.

**WAVED**, in heraldry, is said of a bordure, or any ordinary, or charge, in a coat of arms, having its outlines indented in manner of the rising and falling of waves: it is used to denote, that the first of the family in whose arms it stands, acquired its honours for sea service.

**WAVING**, in the sea-language, is the making signs to a vessel to come near or keep off.

**WAX**, or *Bees Wax*, in natural history, a firm and solid substance, moderately heavy, and of a fine yellow colour, formed by the bees from the farina of flowers. See **ARTS**.

The best sort is that of a lively yellow colour, and an agreeable smell, somewhat like that of honey: when new, it is toughish, yet easy to break; but by age it becomes harder and more brittle, loses its fine colour, and in a great measure its smell.

From the common yellow wax, by the mere effect of sun and air; or by what is called bleaching, is formed what we term white-wax, and some, very improperly, virgin-wax. The greater the surface is in proportion to the quantity, the sooner and more perfectly this operation is performed. The usual way is to melt the wax in hot water; when melted, they press it through a strainer of tolerable fine linen, and pour it into round and very shallow moulds. When hardened by cooling, it is taken out and exposed to the sun and air, sprinkling it now and then with water, and often turning it: by this means it soon becomes white. The best sort is of a clear and almost transparent whiteness, dry, hard, brittle, and of an agreeable smell, like that of the yellow wax, but much weaker.

The common yellow wax is of very great use both in medicine and in many of the arts and manufactures. It is sometimes given internally, as in dysenteries, and other eruptions

erotions of the intestines; but its great use is in the making ointments and plasters for external use, and the greater part of those of the shops owe their consistence to it. The white-wax is also an ingredient in some of the cerates and ointments of the shops; and is used in making candles, and in many of the nicer arts and manufactures, where wax is required.

**Sealing-Wax** is made in the following manner: Take one pound of bees wax; three ounces of fine turpentine; olive-oil, and rosin, finely powdered, of each one ounce: when they are well melted, and the dross taken off, put in an ounce and a half of vermilion, or red-lead, finely ground, and stir them together till they are well incorporated: and when this mixture grows a little cool, roll it into sticks, or in any other form. If you would have it black, instead of vermilion, or red-lead, put in lamp-black. The soft, red, and green-wax, used in large seals to some of our law-writings, are thus made: Melt bees-wax over a gentle heat, with such a proportion of Venice turpentine as, when cold, will give it the due consistence: this is determined by repeated trials, first putting in but little turpentine, and afterwards more and more, till by dropping a piece upon a marble to cool, it is found of the true consistence. They then colour it with red-lead, or vermilion, or with yerditer, or whatever colours they please, the mixture in this state receiving any.

**WAX WORK**, the representation of the faces, &c. of persons living or dead; made by applying plaster of Paris in a kind of paste, and thus forming a mould containing the exact representation of the features. Into this mould melted wax is poured, and thus a kind of masks are formed; which being painted and set with glass eyes, and the figures dressed in their proper habits, they bear such a resemblance that it is difficult to distinguish between the copy and the original.

**WAY**, a passage or road.

The Roman ways are divided into consular, prætorian, military, and public; and of these we have four remarkable ones in England: the first, Watling-street, or Wathing-street, leading from Dover to London, Dunstable, Toucester, Atterton, and the Severn, extending as far as Anglesea in Wales. The second, called Hikenild, or Ikenild-street, stretches from Southampton over the river Isis at Newbridge; thence by Camden and Litchfield; then passes the Derwent, near Derby, and ends at Tinmouth. The third, called Fosse-way, because in some places it was never perfected, but lies as a large ditch, leads from Cornwall through Devonshire, by Tethbury, near Stow in the Wolds; and beside Coventry to Leicester, Newark, and so to Lincoln. The fourth, called Erning, or Erminage-street, extends from St. David's, in Wales, to Southampton.

**WAY of a ship**, is sometimes the same as her rake, or run forward or backward; but this term is most commonly understood of her sailing.

**WAY-WODE**, a title given to the governors of the chief places in the empire of Muscovy, as also in Poland.

**WEAR**, or **WEER**, a great flank or dam in a river, fitted for the taking of fish, or for conveying the stream to a mill.

New wears are not to be made, or others altered, to the nuisance of the public, under a certain penalty.

**WEASEL**, in zoology. See **MUSTELA**.

**WEATHER**, the state or disposition of the atmosphere with regard to heat, cold, wind, rain, frost, &c.

As it is in the atmosphere that all plants and animals live, and as that appears to be the great principle of most animal and vegetable productions, alterations, &c. there does not seem any thing, in all philosophy, of more immediate concernment to us than the state of the weather, and a knowledge of the great influence it has on our bodies. What vast, but regular, alterations a little turn of weather makes in a tube filled with mercury, or spirits of wine, or in a piece of string, &c. every body knows, in the common instance of barometers, thermometers, &c. and it is owing partly to our inattention, and partly to our unequal and intemperate course of living, that we do not feel as great and regular ones in the tubes, chords, and fibres of our own bodies.

**WEATHER-COCK**, a moveable vane in form of a cock, or other shape, placed on high, to be turned round according to the direction of the wind, and point out what quarter the wind blows from,

**WEATHER-GLASSES**. See **BAROMETER**, and **THERMOMETER**.

**WEATHERING**, among sailors, signifies the doubling, or sailing by a head land, or other place.

**WEAVING**, the art of working a web of cloth, silk, or other stuff, in a loom with a shuttle. For the manner of performing which, see **CLOTH**.

**WEB**, a sort of tissue or texture formed of threads interwoven with each other; some whereof are extended in length, and called the warp; and others drawn across, and called the woof. See **CLOTH**.

**Spider's WEB**. See **ARANEA**.

**WEDGE**, one of the mechanical powers. See **MECHANICS**.

**WEDNESDAY**, the fourth day of the week, so called from a Saxon idol named Woden, supposed to be Mars, worshipped on this day.

*Asb-***WEDNESDAY**, the first day of Lent, so called from the custom observed in the ancient christian church of penitents expressing their humiliation at this time, by appearing in sackcloth and ashes.

**WEED**, a common name for all rank and wild herbs, that grow of themselves, to the detriment of other useful herbs they grow among.

**WEED**, in the miners language, denotes the degeneracy of a load or vein of fine metal into an useless marcasite.

**WEEK**, in chronology, a division of time comprising seven days. See **ASTRONOMY**, p. 489.

The origin of this division of weeks, or of computing time by sevenths, is greatly controverted. Some will have it to take its rise from the four quarters or intervals of the moon, between her changes or phases, which, being about seven days distant, gave occasion to the division.

Be this as it will, the division is certainly very ancient. The Syrians, Egyptians, and most of the oriental nations, appear to have used it from all antiquity: though it did not get footing in the west till Christianity brought it in: the Romans reckoned their days not by sevenhs, but by ninths, and the ancient Greeks by decads or tenths.

Indeed, the Jews divided their time by weeks, but it was upon a different principle from the eastern nations.

God

- God himself appointing them to work six days, and to rest the sabbath, in order to keep up the sense and remembrance of the creation; which being effected in six days, he rested the seventh.
- PASSION WEEK**, or the *Holy WEEK*, is the last week in Lent, wherein the church celebrates the mystery of our Saviour's death and passion.
- WEEK**, or **WYCK**, in geography, a parliament and port-town of Scotland, in the shire of Cathness: W. long.  $2^{\circ} 45'$ , N. lat.  $58^{\circ} 40'$ .
- WEEVER**, in ichthyology. See **TRACHINUS**.
- WEIGH**, a weight of cheese, wool, &c. containing 256 pounds avoirdupoise. Of corn, the weigh contains forty bushels; of barley or malt, six quarters. In some places, as Essex, the weigh of cheese is 300 pounds.
- WEIGHING**, the act of examining a body in the balance to find its weight.
- WEIGHING-ANCHOR**, is the drawing it out of the ground it had been cast into, in order to set sail, or quit a port, road, or the like.
- WEIGHT**, in physics, a quality in natural bodies whereby they tend downwards, towards the centre of the earth. Or, weight may be defined, in a less limited manner, to be a power inherent in all bodies whereby they tend to some common point, called the centre of gravity; and that with a greater or less velocity, as they are more or less dense, or as the medium they pass thro' is more or less rare. See **MECHANICS**.
- WEIGHT**, in commerce, denotes a body of a known weight, appointed to be put in the balance against other bodies whose weight is required.
- WELL**, or **WEYL**, an imperial city of Germany, in the circle of Swabia, and duchy of Wirtemberg: E. long.  $8^{\circ} 40'$ ; N. lat.  $48^{\circ} 40'$ .
- WEIMAR**, a city of Germany, in the circle of Upper Saxony, the capital of the Weimar: E. long.  $11^{\circ} 25'$ , N. lat.  $51^{\circ}$ .
- WEISEL**, a river of Poland, and the same with the *vistula*. See **VISTULA**.
- WEISSENBURG**, or **STULWEISSENBURG**, a city of Lower Hungary, situated near the east end of the *Platten* sea, thirty-six miles south-west of Buda.
- WEISSENFELD**, a town of Germany, in the circle of Upper Saxony, and marquisate of Misnia, seventeen miles south-west of Leipzig.
- WELCHPOLE**, a market-town of Montgomeryshire, situated six miles north of Montgomery.
- WELD**, or **WOLD**, in botany. See **RESEDA**.
- WELDING HEAT**, in smithery, a degree of heat given to iron, &c. sufficient only for bending, or doubling it up.
- WELL**, a hole under ground, usually of a cylindrical figure, and walled with stone and mortar: its use is to collect the water of the strata around it.
- WELL**, in the military art, a depth which the miner sinks under ground with branches or galleries running out from it; either to prepare a mine, or to discover and disappoint the enemies mine.
- WELL HOLE** in building, is the hole left in a floor for the stairs to come up through.
- WELLS**, a city of Somersetshire, situated six miles south-west of the city of Bath, both which cities have but one shop.
- This is also the name of a town of Germany, in the circle of Austria, situated eleven miles south of Linz.
- WELLAND**, a river which rises in Leicestershire, and running eastward between the counties of Rutland and Northampton, and afterwards north-east by Stamford, falls into a bay of the German Sea, which divides the counties of Lincoln and Norfolk.
- WELLINBOROUGH**, a market-town of Northamptonshire; situated on the river Nen, ten miles north-east of Northampton.
- WELLINGTON**, a market-town of Shropshire, situated ten miles east of Shrewsbury.
- WEM**, a market-town of Shropshire, situated eight miles north of Shrewsbury.
- WEN**, a tumour or excrescence that arises on different parts of the body, and contains a cystus or bag filled with some peculiar matter.
- WENDOVER**, a borough town of Bucks, six miles south of Aylesbury; which sends two members to parliament.
- WENER**, a lake in Sweden, in the province of Gothland, seventy miles in length, and fifty in breadth.
- WENLOCK**, a borough-town of Shropshire, ten miles south-east of Shrewsbury; which sends two members to parliament.
- WENSUSSEL**, the north division of Jutland, in Denmark, having the Categate sea on the north, the Schag-gerrack sea on the east, the province of Wiburg on the south, and the German Sea on the west.
- WEOBLEY**, a borough-town of Herefordshire; 12 miles north-west of Hereford; which sends two members to parliament.
- WERMELAND**, a province of Sweden, lying between the province of Dalecarlia on the north, and the lake Wener on the south.
- WESEL**, a city of Germany, in the duchy of Cleves: E. long.  $6^{\circ} 5'$ , N. lat.  $51^{\circ} 37'$ .
- WESER**, a river of Germany, which rises in the Land-gravate of Hesse, runs between the circles of Westphalia and Lower Saxony, and falls into the German sea below Carlsat.
- WEST**, one of the cardinal points of the horizon, diametrically opposite to the east; and strictly defined, the intersection of the prime vertical with the horizon, on that side the sun sets in.
- WESTRURY**, a borough-town of Wiltshire, twenty miles north-west of Salisbury; which sends two members to parliament.
- WESTLOW**, a borough town of Cornwall, twenty-three miles south-west of Launceston; which sends two members to parliament.
- WESTMANIA**, a province of Sweden, having Upland on the east, and Wermeland on the west.
- WESTMEATH**, a county of Ireland, in the province of Leinster, bounded by Longford and Cavan on the north; by Eastmeath, on the east; by King's County, on the south; and by the river Shannon, which divides it from Roscommon, on the west.
- WESTMINSTER**; a city which forms the west part of the town which goes by the general name of London; but is under a distinct government; the dean and chapter appointing the high steward, high bailiff, and other officers, who have the government of the city. Here are the king's palaces, and the houses of most of the nobility,

bility, the high court of parliament, and the supreme courts of justice; but there is no bishop of this city. It elects two members of parliament.

**WESTMORELAND**, an English county, bounded by Cumberland on the north, by Yorkshire on the east, by Lancashire on the south, and by the Irish channel on the west.

**WESTPHALIA**, the north-west circle of the empire of Germany; bounded by the German ocean, on the north; by the circle of Lower Saxony, on the east; by the Landgrate of Hesse, the Palatinate of the Rhine, and the electorate of Triers, on the south; and by the Netherlands, on the west: being 200 miles in length, and from 150 to 200 in breadth.

**WESTRAM**, a market town of Kent, under the meridian of London, 44 miles west of Canterbury.

**WETTERAVIA**, the southern division of the Landgrate of Hesse, in Germany, lying along the northern bank of the river Maine, comprehending the counties of Hanau and Nassau.

**WETZLAR**, an imperial city of Germany, in the circle of the Upper Rhine and territory of Wetteravia, situated on the river Lahn, E. long.  $8^{\circ} 15'$ , N. lat.  $50^{\circ} 30'$ .

**WEXFORD**, a county of Ireland, in the province of Munster, bounded by the county of Wicklow on the north, by the ocean on the east and south, and by Kilkenny and Waterford on the west.

Wexford, the capital of this county, is situated at the mouth of the river Slaney, sixty five miles south of Dublin.

**WEYMOUTH**, a port-town of Dorsetshire, situated on a fine bay of the English channel, seven miles south of Dorchester. It sends two members to parliament.

**WHALE**, in ichthyology. See **BALÆNA**, and **PHYSETER**.

**WHARF**, a space on the banks of a haven, creek, or hithe, provided for the convenient loading and unloading of vessels upon.

**WHEAT**, in botany. See **TRITICUM**. For the culture of wheat, see **AGRICULTURE**, p. 60.

**WHEEL**, in mechanics, a simple machine, consisting of a round piece of wood, metal, or other matter, which revolves on an axis. See **MECHANICS**.

**WHELP**, the young of a dog, fox, lion, or any wild beast.

**WHELPS**, in a ship, the seaman's term for those brackets which are set up on the capstan close under the bars; they give the sweep to it, and are so contrived that the cable winding about them may not surge so much as it might otherwise do if the body of the capstan were quite round and smooth.

**WHETSTONE**, a stone which serves for the whetting of knives and other tools upon.

**WHEY**, the serum, or watery part, of milk. See **WHEY**.

**WHIG**, a party in Britain, opposite to the Tories, from whom they differ chiefly in their political principles. See **TORIES**.

The names of whig and tory were not known till about the middle of the reign of Charles II. when these were given as party distinctions. These parties may be considered either with regard to the state, or to religion. The state Tories are either violent, or moderate: the first would have the king to be absolute, and therefore plead

for passive obedience, non-resistance, and the hereditary right of the house of Stewart. The moderate Tories would not suffer the king to lose any of his prerogative; but then they would not sacrifice those of the people. The state whigs are either strong republicans, or moderate ones. The first, says Rapin, are the remains of the party of the long parliament, who attempted to change monarchy to a commonwealth: but these make so slender a figure, that they only serve to strengthen the party of the other whigs. The Tories would persuade the world, that all the whigs are of this kind; as the whigs would make us believe that all the Tories are violent. The moderate state-whigs are much in the same sentiments with the moderate Tories, and desire that the government may be maintained on the ancient foundation: all the difference is, that the first bear a little more to the parliament and people, and the latter to that of the king. In short, the old whigs were always jealous of the encroachments of the royal prerogative, and watchful over the preservation of the liberties and properties of the people.

**WHIP**, or **WHIP-STAFF**, in a ship, a piece of timber, in form of a strong staff, fastened into the helm, for the steersman, in small ships, to hold in his hand, in order to move the rudder and direct the ship.

**WHIRLPOOL**, an eddy, vortex, or gulph, where the water is continually turning round.

These in rivers are very common, from various accidents, and are usually very trivial, and of little consequence. In the sea they are more rare, but more dangerous. Sibbald has related the effects of a very remarkable marine whirlpool among the Orcaades, which would prove very dangerous to strangers, though it is of no consequence to the people who are used to it. This is no fixed to any particular place, but appears in various part of the limits of the sea among those islands. Wherever it appears, it is very furious; and boats, &c. would inevitably be drawn in and perish with it; but the people who navigate them are prepared for it, and always carry an empty vessel, a log of wood, or large bundle of straw, or some such thing, in the boat with them; as soon as they perceive the whirlpool, they toss this within its vortex, keeping themselves out: this substance, whatever it be, is immediately received into the centre, and carried under water; and as soon as this is done, the surface of the place where the whirlpool was becomes smooth, and they row over it with safety; and in about an hour they see the vortex begin again in some other place, usually at about a mile's distance from the first.

**WHIRLWIND**, a wind that rises suddenly is exceeding rapid and impetuous when risen, but is soon spent. See **PNEUMATICS**, p. 495.

**WHISPERING**. See the articles **HEARING**, **ATTENTION**, &c.

**WHISPERING PLACES** depend upon this principle. If the vibrations of the tremulous body are propagated through a long tube, they will be continually reverberated from the sides of the tube into its axis, and by that means prevented from spreading, till they get out of it; whereby they will be exceedingly increased, and the sound rendered much louder than it would otherwise be.

Hence it is that sound is conveyed from one side of a whispering gallery to the opposite one, without being perceived by those who stand in the middle.

**WHIST**,

**WHIST**, a well-known game at cards; so called from the silence observed during the play.

**WHITBY**, a port-town of the north riding of Yorkshire, situated on the German sea, thirty-eight miles north-east of York.

**WHITCHURCH**, a borough-town of Hampshire, situated ten miles north of Winchester. It sends two members to parliament.

**WHITE**, one of the colours of natural bodies.

**WHITE of the eye**, denotes the first tunic or coat of the eye, called albuginea. See **ANATOMY**, p. 289.

**WHITE FRIERS**, a name common to several orders of monks, from their being clothed in a white habit.

**WHITE HORSE**, in ichthyology. See **RAIA**.

**WHITE LEAD**. See **CEKUSE**.

**WHITE SEA**, in geography, a bay of the frozen ocean, in the north of Mulcovy, between Russian Lapland and Samoida.

**WHITE WINE**, wine of a bright transparent colour, bordering on white, thus called to distinguish it from the red wines. See **WINE**.

**WHITEHAVEN**, a port-town of Cumberland, situated on the Irish channel: W. long.  $3^{\circ} 16'$ , N. lat.  $54^{\circ} 30'$ .

**WHITENESS**, the quality which denominates a body white.

**WHITING**, in ichthyology. See **GADUS**.

**WHITES**, in medicine, the same with fluor albus. See **MEDICINE**, p. 164.

**WHITSUNDAY**, a solemn festival of the Christian church, observed on the fiftieth day after Easter, in memory of the descent of the Holy Ghost upon the apostles in the visible appearance of fiery cloven tongues, and of those miraculous powers which were then conferred upon them.

It is called Whitsunday, or White Sunday, because this being one of the stated times for baptism in the ancient church, those who were baptized put on white garments, as types of that spiritual purity they received in baptism. As the descent of the Holy Ghost upon the apostles happened upon the day which the Jews called pentecost, this festival retained the name of pentecost among the Christians.

**W BURG**, the capital of the territory of the same name in Juland: E long  $9^{\circ} 16'$ , N. lat  $56^{\circ} 20'$ .

**WIBURG**, a city and port-town of Russian Finland, situated on the gulph of Finland: E long  $29^{\circ}$ , N. lat  $61^{\circ}$ .

**WICCOMB CHIPPING**, a borough town of Bucks, twelve miles south of Aylesbury. It sends two members to parliament.

**WICK DE DUERSTEDE**, a town of the United Netherlands, in the province of Utrecht, fifteen miles south-east of the city of Utrecht.

**WICKER**, a twig of the osier shrub, single or wrought.

**WICKET**, a small door in the gate of a fortified place, &c. or a hole in a door, through which to view what passes without.

**WICKLIFFISTS**, or **WICKLIFFITES**, a religious sect which sprung up in England in the reign of Edward III. and took its name from John Wickliff, doctor and professor of divinity in the university of Oxford, who maintained that the substance of the sacramental bread and wine remained unaltered after consecration; and opposed the doctrine of purgatory, indulgences, auricular confession, the invocation of saints, and the worship of ima-

ges. He maintained, that the children of the religious may be saved without being baptized; that priests may administer confirmation; that there ought to be only two orders in the church, that of priests, and that of deacons. He made an English version of the Bible; and composed two volumes, called *Aletheia*, that is, Truth, from which John Huse learned most of his doctrines. In short, to this reformer we owe the first hint of the reformation, which was effected about two hundred years after.

**WICKLOW**, a county of Ireland, in the province of Leinster, bounded by the county of Dublin on the north, by the Irish channel on the east, by Wexford on the south, and by Kildare and Katerlagh on the west.

**WICKW ARE**, a market town of Gloucestershire, situated twenty miles south of Gloucester.

**WIDGEON**, in ornithology. See **ANAS**.

**WIDOW**, a woman who has lost her husband.

**WIFE**, a married woman, or one joined with, and under the protection of, an husband. See **HUSBAND**.

**WIGGAN**, a borough-town of Lancashire, twenty-nine miles south of Lancaster. It sends two members to parliament.

*Isle of* **WIGHT**, part of the county of Southampton, and separated from it by a narrow channel, is about twenty miles long, and twelve broad. The chief town is Newport.

**WIGTOWN**, a borough and port-town of Scotland, in the shire of Gallo way, situated on a bay of the Irish channel, ninety miles south-west of Edinburgh.

**WILDERNESS**, in gardening, a kind of grove of large trees, in a spacious garden, in which the walks are commonly made either to intersect each other in angles, or have the appearance of meanders and labyrinths.

**WILKOMERS**, a city of Poland, in the duchy of Lithuania: E. long.  $25^{\circ}$ , N. lat.  $55^{\circ} 30'$ .

**WILL**, or *last WILL*, in law, signifies the declaration of a man's mind and intent relating to the disposition of his lands, goods, or other estate, or of what he would have done after his death.

In the common law, there is a distinction made between a will and a testament; as that is called a will, where lands or tenements are given; and when the disposition concerns goods and chattels alone, it is termed a testament. See **TESTAMENT**.

**WILL-with-a-wisp**, or *Jack-with-a-lantern*, a meteor known among the people under these names, but more usually among authors under that of *ignis fatuus*.

This meteor is chiefly seen in summer-nights, frequenting meadows, marshes, and other moist places. It seems to arise from a viscous exhalation, which being kindled in the air, reflects a sort of thin flame in the dark, without any sensible heat.

It is often found flying along rivers, hedges, &c. by reason it there meets with a stream of air to direct it. The *ignis fatuus*, says Sir Isaac Newton, is a vapour shining without heat; and there is the same difference between this vapour and flame, as between rotten wood shining without heat and burning coals of fire.

**WILLIAMSBURG**, capital of the colony of Virginia, situated in James-county, between James-river and York-river: W. long.  $76^{\circ} 30'$ , N. lat.  $37^{\circ} 20'$ .

**WILLIAM'S FORT**, a fort belonging to the English East India

- India company, situated on the western branch of the river Ganges, in the province of Bengal: E. long. 87°, N. lat. 2° 45'.
- WILLIAMSTAT**, a port-town of Holland, situated on the sea called Hollands-Deep, fourteen miles south of Rotterdam.
- WILLOW**, in botany. See **SALIX**.
- WILNA**, a city of Poland, capital of the great duchy of Lithuania, situated on a river of the same name: E. long. 25° 15', N. lat. 55°.
- WILTON**, a borough-town of Wiltshire, situated on the river Willey, six miles north-west of Salisbury. It sends two members to parliament.
- WILTSHIRE**, a county of England, bounded by Gloucestershire and Oxfordshire on the north, by Berkshire and Hampshire on the east, by Dorsetshire on the south, and by Somersetshire on the west.
- WINCHELSEA**, a borough and port-town of Sussex, situated on a bay of the English channel, thirty miles east of Lewes. It sends two members to parliament.
- WINCHESTER**, the capital city of Hampshire, situated on the river Itching, six y-five miles south-west of London.
- WIND**. See **PNEUMATICS**, p. 495.
- WIND-MILL**, a kind of mill, the internal parts of which are much the same with those of a water-mill; from which however it differs, in being moved by the impulse of the wind upon its vanes, or sails, which are to be considered as a wheel on the axle. See **MECHANICS**.
- WIND-FLOWER**, in botany. See **ANEMONE**.
- WIND GALL**, a name given by our farriers to a distemperature of horses. See **FARRIERY**, p. 575.
- WIND SAILS**, in a ship, are made of the common sail-cloth, and are usually between twenty-five and thirty feet long, according to the size of the ship, and are of the form of a cone ending obtusely: when they are made use of, they are hoisted by ropes to about two thirds or more of their height, with their basis distended circularly by hoops, and their apex hanging downwards in the hatch ways of the ship; above each of these, one of the common sails is so disposed, that the greatest part of the air rushing against it, is directed into the wind-fail, and conveyed, as through a funnel, into the upper parts of the body of the ship.
- WIND TACKLE-BLOCKS**, in a ship, are the main double blocks which being made fast to the end of a small cable, serve for hoisting of goods into the ship, &c.
- To WIND, or WIND a ship*, signifies to bring her head about. *How winds or wends the ship?* is a question asked by mariners, concerning a ship under sail; signifying as much as, upon what point of the compass does she lie with her head?
- WINDWARD**, in the sea-language, denotes any thing towards that point from whence the wind blows, in respect of a ship: thus windward-tide, is the tide which runs against the wind.
- WINDAGE** of a gun, the difference between the diameter of the bore, and the diameter of the ball.
- WINDLASS**, a machine used to raise huge-weights withal, as guns, stones, an hors, &c.
- It is very simple, consisting only of an axis, or roller, supported horizontally at the two ends, by two pieces of wood and a pulley: the two pieces of wood meet at top, being placed diagonally so as to prop each other; the axis, or roller goes through the two pieces, and turns in them. The pulley is fastened at top where the pieces join. Lastly, there are two staves or hand-pikes which go through the roller, where y it is turned, and the rope which comes over the pulley is wound off and on the same.
- WINDLASS**, in a ship, is an instrument in small ships, placed upon the deck, just abast the fore mast. It is made of a piece of timber six or eight feet square, in form of an axle-tree, whose length is placed horizontally upon two pieces of wood at the ends thereof, and upon which it is turned about by the help of handspikes put into holes made for that purpose. This instrument serves for weighing anchors, or hoisting of any weight in or out of the ship, and will purchase more than any capstan, and that without any danger to those that heave; for if in heaving the windlafs about, any of the handspikes should happen to break, the windlafs would fall of itself.
- WINDOW**, an aperture or open place in the wall of a house, to let in the wind and light. See **ARCHITECTURE**, p. 357.
- WINDSOR**, a borough-town of Berkshire, twenty miles west of London, most remarkable for the magnificent palace or castle situated there on an eminence, which commands the adjacent country for many miles, the river Thames running at the foot of the hill. The knights of the garter are installed in the royal chapel here. It sends two members to parliament.
- WINE**, a brisk, agreeable, spirituous and cordial liquor, drawn from vegetable bodies, and fermented.
- All sorts of vegetables, fruits, seeds, roots, &c. afford wine; as grapes, currants, mulberries, elder-berries, cherries, apples, pulse, beans, pease, turneps, radishes, and even grafs itself. Hence under the class of wines, or vinous liquors, come not only wines absolutely so called, but also ale, cyder, &c. See **BREWING**, and **CHEMISTRY**, p. 95, 161.
- Wine in France is distinguished, from the several degrees and steps of its preparation, into, 1. *Mere goutte*, mother-drop, which is the virgin wine, or that which runs of itself out at the top of the vat wherein the grapes are laid, before the vintager enters to tread or stamp the grapes. 2. *Muck*, *sturmst*, or *stum*, which is the wine or liquor in the vat, after the grapes have been trod or stamped. 3. *Pressed wine*, being that squeezed with a press out of the grapes half bruited by the treading. The hulks left of the grapes are called *rope*, *muck*, or *mark*; by throwing water upon which and pressing them afresh, they make a liquor for servants use, answerable to our cyderkin, and called *boisson*. 4. *Sweet wine*, is that which has not yet worked nor fermented. 5. *Bouru*, that which has been prevented working by casting in cold water. 6. *Worked wine*, that which has been let work in the vat, to give it a colour. 7. *Boiled wine*, that which has had a boiling before it worked, and which by that means still retains its native sweetness. 8. *Strained wine*, that made by steeping dry grapes in water, and letting it ferment of itself. Wines are also distinguished with regard to their colour into white wine, red wine, claret wine, pale wine, rose, or black wine; and with regard to their country, or the soil that produces them, into French wines, Spanish wines, Rhenish wines, Hungarian wines, Greek wines, Canary wines, &c. and more particularly

particularly into Port wine, Madeira wine, Burgundy wine, Champain wine, Falernian wine, Tockay wine, Schiras wine, &c.

*Spirit of WINE.* See CHEMISTRY, p. 163.

WING, that part of a bird, in'ect, &c. whereby it is enabled to fly. See NATURAL HISTORY.

WINGS, in heraldry, are borne sometimes single, sometimes in pairs; in which case, they are called conjoined. When the points are downward, they are said to be inverted; when up, elevated.

WINGS, in military affairs, are the two flanks or extremes of an army, ranged in form of a battle; being the right and left sides thereof.

WINGS, in fortification, denote the longer sides of horn-works, crown-works, tenailles, and the like out-works; including the ramparts and parapets; with which they are bounded on the right and left, from their gorge to their front.

WINSLOW, a market-town of Bucks, six miles north of Ailesbury.

WINSTER, a market-town of Darbyshire, situated ten miles north of Darby.

WINTER, one of the four seasons or quarters of the year. See ASTRONOMY, p. 546.

WINTER'S BARK, in botany, a name given to the bark of the white or wild cinnamon tree. See CINNAMON.

WINTERTONNESSE, the north cape of the county of Norfolk, four miles north of Yarmouth.

WIRE, a piece of metal drawn through the hole of an iron into a thread of a fineness answerable to the hole it pass'd through.

Wires are frequently drawn so fine, as to be wrought along with other threads of silk, wool, flax, &c.

The metals most commonly drawn into wire, are gold, silver, copper, and iron. Gold-wire is made of cylindrical ingots of silver, covered over with a skin of gold, and thus drawn successively through a vast number of holes, each smaller and smaller, till at last it is brought to a fineness exceeding that of a hair. That admirable ductility which makes one of the distinguishing characters of gold, is no where more conspicuous than in this gilt wire. A cylinder of forty-eight ounces of silver, covered with a coat of gold, only weighing one ounce, as Dr. Halley informs us, is usually drawn into a wire, two yards of which weigh no more than one grain; whence ninety-eight yards of the wire weigh no more than forty-nine grains, and one single grain of gold covers the ninety-eight yards; so that the ten thousandth part of a grain is above one-eighth of an inch long.

WIRE of Lapland. The inhabitants of Lapland have a sort of shining slender substance in use among them on several occasions which is much of the thickness and appearance of our silver-wire, and is therefore called, by those who do not examine its structure or substance, Lapland-wire. It is made of the sinews of the rein-deer, which being carefully separated in the eating, are, by the women, after soaking in water, and beating, spun into a sort of thread, of admirable fineness, and strength, when wrought to the smallest filaments; but when larger, is very strong, and fit for the purposes of strength and force. Their wire, as it is called, is made of the finest of these threads, covered with tin. The women do this business, and the way they take is to melt a piece of tin; and pla-

cing at the edge of it a horn with a hole through it, they draw these sinewy threads, covered with the tin, through the hole, which prevents their coming out too thick covered. This drawing is performed with their teeth; and there is a small piece of bone placed at the top of the hole, where the wire is made flat, so that we always find it rounded on all sides but one, where it is flat.

This wire they use in embroidering their cloaths as we do gold and silver; they often sell it to strangers, under the notion of its having certain magical virtues.

WIRKSWORTH a market-town of Darbyshire, situated six miles north of Darby.

WISBEACH: a market-town of the isle of Ely, in Cambridgeshire, situated fifteen miles north of Ely.

WISDOM, usually denotes a higher and more refined notion of things immediately presented to the mind, as it were, by intuition without the assistance of ratiocination.

WISTON. a market-town of Pembrokehire, situated ten miles north of Pembroke.

WIT is a quality of certain thoughts and expressions: the term is never applied to an action nor to a passion, and as little to an external object.

However difficult it may be, in every particular instance, to distinguish a witty thought or expression from one that is not so: yet in general it may be laid down, that the term *wit* is appropriated to such thoughts and expressions as are ludicrous, and also occasion some degree of surprise by their singularity. Wit also, in a figurative sense, expresses that talent which some men have of inventing ludicrous thoughts or expressions: we say commonly, *a witty man.* or *a man of wit.*

Wit in its proper sense, as explained above, is distinguishable into two kinds; wit in the thought, and wit in the words or expression. Again, wit in the thought is of two kinds; ludicrous images, and ludicrous combinations of things that have little or no natural relation.

Ludicrous images that occasion surprise by their singularity, as having little or no foundation in nature, are fabricated by the imagination: and the imagination is well qualified for the office; being of all our faculties the most active, and the least under restraint. Take the following example.

*Shylock* You knew (none so well, none so well as you) of my daughter's flight.

*Salino:* That's certain: I, for my part, knew the tailor that made the wings she flew withal.

*Merchant of Venice, act 3. sc. 1.*

The image here is undoubtedly witty. It is ludicrous: and it must occasion surprise; for having no natural foundation, it is altogether unexpected.

The other branch of wit in the thought, is that only which is taken notice of by Addison, following Locke, who defines it "to lie in the assemblage of ideas; and putting those together, with quickness and variety, wherein can be found any resemblance or congruity, thereby to make up pleasant pictures and agreeable visions in the fancy." It may be defined more curtly, and perhaps more accurately, "a junction of things by distant and fanciful relations, which surprise because they are unexpected." The following is a proper example.

We grant although he had much wit,  
H<sup>e</sup> was very shy of using it,

9 B

As

As being loth to wear it out;  
And therefore bore it not about,  
Unless on holidays, or so,  
As men their best apparel do.

*Hudibras, canto 1.*

Wit is of all the most elegant recreation: the image enters the mind with gaiety, and gives a sudden flash which is extremely pleasant. Wit thereby gently elevates without straining, raises mirth without dissoluteness, and relaxes while it entertains.

Wit in the expression, commonly called a *play of words*, being a bastard sort of wit, is reserved for the last place. We proceed to examples of wit in the thought; and first of ludicrous images.

Falstaff, speaking of his taking Sir John Coleville of the Dale:

Here he is, and here I yield him; and I beseech your Grace, let it be book'd with the rest of this day's deeds; or, by the Lord, I will have it in a particular ballad else, with mine own picture on the top of it, Coleville kissing my foot: to the which course if I be enforced, if you do not all shew like gilt twopences to me; and I, in the clear sky of fame, o'erhine you as much as the full moon doth the cinders of the element, which shew like pins' heads to her; believe not the word of the noble. Therefore let me have right, and let desert mount.

*Second Part, Henry IV. act 4. sc. 6.*

I knew, when seven justices could not take up a quarrel, but when the parties were met themselves, one of them them thought but of an *if*; as, if you had said so, then I said so; and they shook hands, and swore brothers. Your *if* is the only peace-maker; much virtue is in *if*.

*Shakespeare.*

For there is not through all nature another so callous and insensible a member as the world's posteriors, whether you apply to it the toe or the birch.

*Preface to a Tale of a Tub.*

The other branch of wit in the thought, *viz.* ludicrous combinations and oppositions, may be traced through various ramifications. And, first, fanciful causes assigned that have no natural relation to the effects produced:

*Lancaster.* Fare you well, Falstaff; I, in my condition, shall better speak of you than you deserve. [Exit.]

*Falstaff.* I would you had but the wit; 'twere better than your dukedom. Good faith, this same young sober-blooded boy doth not love me; nor a man cannot make him laugh; but that's no marvel, he drinks no wine. There's never any of these demure boys come to any proof; for thin drink doth so overcool their blood, and making many fish-meals, that they fall into a kind of male green-sickness; and then, when they marry, they get wenches. They are generally fools and cowards; which some of us should be too, but for inflammation. A good therris-sack hath a twofold operation in it: it ascends me into the brain; dries me there all the foolish, dull, and crudy vapours which environ it; make it apprehensive, quick, forgetive, full of nimble, fiery, and delectable shapes; which delivered o'er to the voice, the tongue, which is the birth, becomes excellent wit. The second property of your excellent therris is, the warming of the blood; which before cold and fetid, left the liver white and pale; which is the badge of pusillanimity

and cowardice: but the therris warms it, and makes it course from the inwards to the parts extreme; it illuminateth the face, which, as a beacon, gives warning to all the rest of this little kingdom, man, to arm; and then the vital commoners and inland petty spirits muster me all to their captain, the heart; who, great, and puff'd up with this retinue, doth any deed of courage; and thus valour comes of therris. So that skill in the weapon is nothing without sack, for that sets it a-work; and learning a mere hoard of gold kept by a devil, till sack commences it, and lets it in act and use. Hereof comes it that Prince Harry is valiant; for the cold blood he did naturally inherit of his father, he hath, like lean, sterile, and bare land, manured, husbanded, and till'd with excellent endeavour of drinking good and good store of fertile therris, that he is become very hot and valiant. If I had a thousand sons, the first human principle I would teach them, should be to forswear thin potations, and to addict themselves to sack.

*Second Part of Henry IV. act 4. sc. 7.*

The trenchant blade, toledo trusty,  
For want of fighting was grown rusty,  
And ate into itself, for lack  
Of some body to hew and hack.  
The peaceful scabbard where it dwelt  
The rancor of its edge had felt:  
For of the lower end two handful  
It had devoured, 'twas so manful;  
And so much scorn'd to lurk in case,  
As if it durst not shew its face.

*Hudibras, canto 1.*

To account for effects by such fantastical causes, being highly ludicrous, is quite improper in any serious composition. Therefore the following passage from Cowley, in his poem on the death of Sir Henry Wootton, is in a bad taste.

He did the utmost bounds of knowledge find,  
He found them not so large as was his mind.  
But, like the brave Pellæan youth, did moan,  
Because that art had no more worlds than one.  
And when he saw that he through all had past,  
He dy'd, lest he should idle grow at last.

Fanciful reasoning:

*Falstaff.* Imbowel'd!—if thou imbowel me to day, I'll give you leave to powder me, and eat me to-morrow! S'blood, 'twas time to counterfeit, or that hot termagant Scot had paid me scot and lot too. Counterfeit? I lie, I am no counterfeit: to die is to be a counterfeit; for he is but the counterfeit of a man, who hath not the life of a man; but to counterfeit dying, when a man thereby liveth, is to be no counterfeit, but the true and perfect image of life indeed.

*First Part Henry IV. act 1. sc. 10.*

*Clown.* And the more pity that great folk should have countenance in this world to drown or hang themselves, more than their even Christians.

*Hamlet, act 5. sc. 2.*

*Pedro.* Will you have me, Lady?

*Beatrice.* No, my Lord, unless I might have another for working days. Your Grace is too costly to wear every day.

*Much ado about nothing, Act 2. sc. 5.*

*Jessica.*

*Jessica.* I shall be saved by my husband; he hath made me a Christian.

*Launcelot.* Truly the more to blame he; we were Christians enough before, e'en as many as could well live by one another: this making of Christians will raise the price of hogs; if we grow all to be pork-eaters, we shall not have a rasher on the coals for money.

*Merchant of Venice, Act 3. sc. 6.*

But Hudibras gave him a twitch,  
As quick as lightning, in the breech,  
Just in the place where honour's lodg'd,  
As wise philosophers have judg'd;  
Because a kick in that part, more  
Hurts honour, than deep wounds before.

*Hudibras, canto 3.*

Ludicrous junction of small things with great, as of equal importance:

This day black omens threat the brightest fair  
That e'er deserv'd a watchful spirit's care:  
Some dire disaster, or by force, or slight:  
But what, or where, the fates have wrapt in night:  
Whether the nymph shall break Diana's law;  
Or some frail china jar receive a flaw:  
Or stain her honour, or her new brocade;  
Forget her pray'rs, or miss a masquerade;  
Or lose her heart, or necklace, at a ball;  
Or whether Heav'n has doom'd that Shock must fall.

*Rape of the Lock, canto ii. 101.*

One speaks the glory of the British Queen,  
And one describes a charming Indian screen.

*Ibid. canto iii. 13.*

Then flash'd the living lightning from her eyes,  
And screams of horror rend th'affrighted skies.  
Not louder shrieks to pitying heav'n are cast,  
When husbands, or when lapdogs, breathe their last;  
Or when rich china vessels fall'n from high,  
In glittering dust and painted fragments lie!

*Ibid. canto iii. 155.*

Not youthful kings in battle seiz'd alive,  
Not scornful virgins who their charms survive,  
Not ardent lovers robb'd of all their bliss,  
Not ancient ladies when refus'd a kiss,  
Nor tyrants fierce that unrepenting die,  
Nor Cynthia when her manteau's pinn'd awry,  
E'er felt such rage, resentment, and despair,  
As thou, sad virgin! for thy ravish'd hair.

*Ibid. canto iv. 3.*

Joining things that in appearance are opposite. As for example, where Sir Roger de Coverley, in the spectator, speaking of his widow,

That he would have given her a coal-pit to have kept her in clean linen; and that her finger should have sparkled with one hundred of his richest acres.

Premises that promise much and perform nothing. Cicero upon this article says,

Sed scitis esse notissimum ridiculi genus, cum aliud expectamus, aliud dicitur: hic nobismetipsis nos error risum movet.

*De oratore, l. 2. c. 63.*

*Beatrice.*—With a good leg and a good foot, uncle, and money enough in his purse, such a man would win any

woman in the world, if he could get her good will.  
*Much ado about nothing, Act. 2. sc. 1.*

*Beatrice.* I have a good eye, uncle, I can see a church by day light.

Having discussed wit in the thought, we proceed to what is verbal only, commonly called a *play of words*. This sort of wit depends, for the most part, upon chusing a word that hath different significations: by this artifice, hocus-pocus tricks are played in language; and thoughts plain and simple take on a very different appearance. Play is necessary for man, in order to refresh him after labour; and accordingly man loves play: he even relishes a play of words: and it is happy for us, that words can be employed, not only for useful purposes, but also for our amusement. This amusement accordingly, though humble and low, is relished by some at all times, and by all at some times, in order to unbend the mind.

It is remarkable, that this low species of wit, has, at one time or other, made a figure in most civilized nations, and has gradually gone into disrepute. So soon as a language is formed into a system, and the meaning of words is ascertained with tolerable accuracy, opportunity is afforded for expressions, which, by the double meaning of some words, give a familiar thought the appearance of being new; and the penetration of the reader or hearer is gratified, in detecting the true sense disguised under the double meaning. That this sort of wit was in England deemed a reputable amusement, during the reigns of Elizabeth and James I is vouched by the works of Shakespear, and even by the writings of grave divines. But it cannot have any long endurance: for as language ripens, and the meaning of words is more and more ascertained, words held to be synonymous diminish daily; and when those that remain have been more than once employed, the pleasure vanisheth with the novelty.

We proceed to examples, which, as in the former case, shall be distributed into different classes.

A seeming resemblance from the double meaning of a word:

Beneath this stone my wife doth lie;  
She's now at rest, and so am I.

A seeming contrast from the same cause, termed a *verbal antithesis*, which hath no despicable effect in ludicrous subjects:

Whilst Iris his cosmetic wash would try  
To make her bloom revive, and lovers die.  
Some ask for charms, and others philters chuse,  
To gain Corinna, and their quartans lose.

*Dispensary, canto 2.*

And how frail nymphs, oft, by abortion, aim  
To lose a substance, to preserve a name.

*Ibid. canto 3.*

While nymphs take treats, or assignations give.

*Rape of the Lock.*

Other seeming connections from the same cause:

Will you employ your conqu'ring sword,  
To break a fiddle and your word?

*Hudibras, canto 2.*

To whom the knight with comely grace  
Put off his hat to put his case.

*Hudibras, part 3, canto 3.*

Here

Here Britain's statesmen oft the fall foredoom  
Of foreign tyrants, and of nymphs at home ;  
Here thou, great Anna whom three realms obey,  
Dost sometimes counsel take—and sometimes tea.

*Rape of the Lock, canto 3. l. 5.*

O'er their quietus where fat judges dose,  
And lull their cough and conscience to repose.

*Dispensary, canto 1.*

Speaking of Prince Eugene :

This general is a great taker of snuff as well as of  
towns.

*Pope, Key to the Lock,*

Exul mentisque domusque.

*Metamorphoses, lib. ix. 409.*

A seeming opposition from the same cause :

Hic quiescit qui nunquam quievit.

Again,

So like the chances are of love and war,  
That they alone in this distinguish'd are ;  
In love the victors from the vanquish'd fly,  
They fly that wound, and they pursue that die.

*Waller.*

What new-found witchcraft was in thee,  
With thine own cold to kindle me ?  
Strange art ; like him that should devise  
To make a burning glass of ice.

*Cowley.*

Wit of this kind is unfuitable in a serious poem ; witness  
the following line in Pope's Elegy to the memory of an  
unfortunate lady :

Cold is that breast which warm'd the world before.

This sort of writing is finely burlesqued by Swift :

Her hands, the softest ever felt,  
Though cold would burn, though dry would melt.

*Strepson and Chloe.*

Taking a word in a different sense from what is meant,  
comes under wit, because it occasions some slight degree of  
surprise :

*Beatrice.* I may sit in a corner, and cry *Heigh ho!* for  
a husband.

*Pedro* Lady Beatrice, I will get you one.

*Beatrice.* I would rather have one of your father's get-  
ting. Hath your Grace ne'er a brother like you ? Your  
father got excellent husbands, if a maid could come by  
them.

*Much ado about nothing, act 2. sc. 5.*

*Falstaff.* My honest lads, I will tell you what I am  
about.

*Pistol.* Two yards and more.

*Falstaff.* No quips now, Pistol : indeed, I am in the  
waste two yards about : but I am now about no waste ; I  
am about thrift.

*Merry Wives of Windsor, act 1. sc. 7.*

*Lo. Sands.*—By your leave, sweet ladies,  
If I chance to talk a little wild, forgive me :  
I had it from my father.

*Anno bullen.* Was he mad, Sir ?

*Sands.* O, very mad, exceeding mad, in love too ;  
But he would bite none—

*K. Henry VIII.*

An assertion that bears a double meaning, one right, one  
wrong, but so connected with other matters as to direct  
us to the wrong meaning, is a species of bastard wit which  
is distinguished from all others by the name *pun*. For ex-  
ample,

*Paris.*—Sweet Helen, I must woo you  
To help unarm our Hector : his stubborn buckles,  
With these your white enchanting fingers touch'd,  
Shall more obey, than to the edge of steel,  
Or force of Greekish sinews ; you shall do more  
Than all the island kings, disarm great Hector

*Troilus and Gressida, act 3. sc. 2:*

The pun is in the close. The word *disarm* has a double  
meaning : it signifies to take off a man's armour, and also  
to subdue him in fight. We are directed to the latter sense  
by the context ; but with regard to Helen, the word  
holds only true in the former sense. We go on with other  
examples :

Esse nihil dicis quicquid petis, improbe Cinna :  
Si nil, Cinna, petis, nil tibi, Cinna, nego.

*Marshall, l. 3. epigr. 61.*

*Chief Justice.* Well ! the truth is, Sir John, you live  
in great intamy.

*Falstaff.* He that buckles him in my belt cannot live in  
less.

*Chief Justice.* Your means are very slender, and your  
waste is great.

*Falstaff.* I would it were otherwise : I would my means  
were greater, and my waste slenderer.

*Second part Henry IV. act 1. sc. 5.*

*Celia.* I pray you bear with me, I can go no further.

*Clown.* For my part, I had rather bear with you than  
bear you : yet I should bear no cross if I did bear you ;  
for I think you have no money in your purse.

*As you like it, act 2. sc. 4.*

He that imposes an oath makes it,  
Not he that for convenience takes it,  
Then how can any man be said  
To break an oath he never made ?

*Hudibras, part 2. canto 2.*

The seventh satire of the first book of Horace is purposely  
contrived to introduce at the close a most execrable pun.  
Talking of some infamous wretch whose name was *Rex Ru-  
pilius*,

Perius exclamat, Per magnos, Brute, deos te

Oro, qui reges confueris tollere, cur non

Hunc regem jugulas ? Operum hoc, mihi crede, tuorum  
est.

Though playing with words is a mark of a mind at ease,  
and disposed to any sort of amusement, we must not thence  
conclude that playing with words is always ludicrous.  
Words are so intimately connected with thought, that if  
the subject be really grave, it will not appear ludicrous even  
in this fantastic drels. We are, however, far from recom-  
mending it in any serious performance : on the contrary,  
the discordance between the thought and expression must  
be disagreeable ; witness the following specimen.

He

He hath abandoned his physicians. Madam, under whose practices he hath persecuted time with hope; and finds no other advantage in the process, but only the losing of hope by time.

*All's well that ends well, act 1. sc. 1.*

*K. Henry.* O my poor kingdom, sick with civil blows! When that my care could not with-hold thy riots, What wilt thou do when riot is thy care?

*Second part K. Henry IV.*

If any one shall observe, that there is a third species of wit, different from those mentioned, consisting in sounds merely, we are willing to give it place. And indeed it must be admitted, that many of Hudibras's double rhymes come under the definition of wit given in the beginning of this article: they are ludicrous, and their singularity occasions some degree of surprize. Swift is not less successful than Butler in this sort of wit; witness the following instances: *Goddest—Boddice. Pliny—Nicolini. Iscariots—Chariots. Mitre—Nitre. Dragon—Suf-fragan.*

A repartee may happen to be witty: but it cannot be considered as a species of wit; because there are many repartees extremely smart, and withal extremely serious. We give the following example. A certain petulant Greek, objecting to Anacharis that he was a Scythian: True, says Anacharis, my country disgraces me, but you disgrace your country. This fine turn gives surprize; but it is far from being ludicrous.

**WITCHCRAFT**, a kind of sorcery, especially in women, in which it is ridiculously supposed that an old woman, by entering into a contract with the devil, is enabled, in many instances, to change the course of nature; to raise winds; perform actions that require more than human strength; and to afflict those who offend them with the sharpest pains, &c. In the times of ignorance and superstition, many severe laws were made against witches, by which great numbers of innocent persons, distressed with poverty and age, were brought to a violent death; but these are now happily repealed. See *LAW*, Tit. xxxiii 8.

**WITENA MOT.** or **WITENA-GEMOT**, among our Saxon ancestors, was a term which literally signified the assembly of the wise men, and was applied to the great council of the nation of latter-days called the parliament.

**WITEPSKI**, the capital of the palatinate of the same name, in the duchy of Lithuania, in Poland: E. long 30°, N. lat. 56°.

**WITHAM**, a market-town of Essex, ten miles north-east of Chelmsford.

**WITHERS** of a horse, the juncture of the shoulder-bones at the bottom of the neck and main, towards the upper part of the shoulder.

**WITNESS**, in law, a person who gives evidence in any cause, and is sworn to speak the truth the whole truth, and nothing but the truth. See *LAW*, Tit. xxi. 4, &c. and Tit. xxxi. 1, &c.

**WITNEY**, a market-town of Oxfordshire, seven miles west of Oxford. Here is the greatest manufacture of blankets in England.

**WITTENBURG**, a city of Germany, in the circle of Upper Saxony, fifty miles north of Dresden.

**WITTLESEYMER**, a lake in the isle of Ely, on the confines of Huntingdonshire, six miles long and three broad.

**WIVELSCOMB**, a market-town of Somersethshire, situated twenty-seven miles south-west of Wells.

**WOAD**, in botany. See *ISARIS*.

**WOBURN**, a market-town of Bedfordshire, ten miles south of Bedford.

**WOLAW**, the capital of a duchy of the same name, in Bohemia: E. long. 16° 38', N. lat. 51° 22'.

**WOLF**, in zoology. See *CANIS*.

**WOLFEMBTLE**, a city of Germany, in the circle of lower Saxony, and duchy of Brunfwick: E. long. 10° 32'. N. lat. 52° 20'.

**WOLFERDYKE**, an island of the united Netherlands, in the province of Zealand, situated between the islands of north Beveland and south Beveland.

**WOLGA**, a large river of Russia, which rising in the north of that empire, runs south-east till it falls into the Caspian sea, about fifty miles below Astracan, after its having run a course of between two and three thousand miles.

**WOLGAST**, a city and port-town of Germany, in the circle of Upper Saxony, and duchy of Pomerania, subject to Sweden: E. long. 14° 5', N. lat. 54° 12'.

**WOLKOWSKA**, a city of Poland, in the duchy of Lithuania, and palatinate of Novogrodeck: E. long. 24°, N. lat. 53°.

**WOLLIN**, a town and island of Pomerania, situated in the Baltic sea, at the mouth of the river Oder, subject to the king of Prussia.

**WOLODOMIR**, the capital of a province of the same name in Russia: E. long. 30° 5', N. lat. 57° 40'.

**WOLOGDA**, the capital of a province of the same name in Russia, situated on the river Dwina: E. long. 42° 20', N. lat. 59°.

**WOLVERHAMPTON**, a market-town of Staffordshire, eleven miles south of Stafford.

**WOLVES-TEETH**, of an horse, are over-grown grinders, the points of which being higher than the rest, prick his tongue and gums in feeding, so as to hinder his chewing. They are seldom met with in any besides young horses; but if they be not daily worn by chewing, they will grow up even to pierce the roof of the mouth.

**WOMAN**, the female of man. See *HOMO*.

**WOMB**. See *ANATOMY*, p. 274.

**WOOD**, a solid substance, whereof the trunks and branches of trees consist.

The wood is all that part of a tree included between the bark and the pith. For the structure of the pith, bark, wood, &c. of plants, see *AGRICULTURE*, p. 40.

**WOODBIDGE**, a market-town of Suffolk, situated twenty-six miles south-east of Bury.

**WOOD COCK**, in ornithology. See *SCOLOPAX*.

**WOOD LOUSE**, in zoology. See *ONISCUS*.

**WOOD-PECKER**, in ornithology. See *PICUS*.

**WOODSTOCK**, a borough-town of Oxfordshire, situated seven miles north of Oxford. It sends two members to parliament.

**WO F**, among manufacturers, the threads which the weaver's shut across with an instrument called the shuttle, See *CLOTH*.

**WOOL**, the covering of sheep. See *OVIS*.

**WOOLWICH**, a market-town of Kent, situated on the river Thames, six miles east of London.

**WORCESTER**, the capital city of worcestershire, situated

- ted on the river Severn, 110 miles north-west of London: W. long.  $2^{\circ} 15'$ , N. lat.  $52^{\circ} 5'$ .
- WORCUM**, a town of Holland, situated on the river Waal, twenty-three miles east of Rotterdam. This is also the name of a port-town of the United Netherlands, situated on the province of Friesland, on the Zuyder-sea, twenty miles south-west of Lewarden.
- WORD**, in language, an articulate sound designed to represent some idea. See **GRAMMAR** and **LANGUAGE**.
- WORKSOP**, a market-town of Nottinghamshire, situated twenty miles north of Nottingham.
- WORLD**, the assemblage of parts which compose the globe of the earth. See **GEOGRAPHY**, and **ASTRONOMY**.
- WORMS**. See **NATURAL HISTORY**.
- WORMS** in medicine. See **MEDICINE**, p. 160.
- Earth-Worm*. See **LUMBRICUS**.
- WORM**, in gunnery, a screw of iron, to be fixed on the end of a rammer, to pull out the wad of a firelock, carbine, or pistol, being the same with the wad-hook, only the one is more proper for small arms, and the other for cannon.
- WORM**, in chemistry, is a long, winding, pewter pipe, placed in a tub of water, to cool and condense the vapours in the distillation of spirits.
- WORMS**, in geography, an imperial city of Germany, in the palatinate of the Rhine: E. long.  $8^{\circ} 5'$ , N. lat.  $49^{\circ} 38'$ .
- WORMWOOD**, in botany. See **ARTEMISIA**.
- WORSLED**, a kind of woolen thread, which, in the spinning, is twilled harder than ordinary. It is chiefly used either wove or knit into stockings, caps, gloves, or the like.
- WORSTED**, a market-town of Norfolk, situated seven miles north of Norwich.
- WOTFON**, a market-town of Gloucestershire, situated seventeen miles south of Gloucester.
- WOTTON BASSET**, a borough-town of Wiltshire, twenty-five miles north of Salisbury; which sends two members to parliament.
- WOUND**, in forgery. See **SURGERY**, p. 643.
- WRASSE**, or **OLD-WIFE**, in ichthyology. See **LABRUS**.
- WREATH**, in heraldry, a roll of fine linen or silk (like that of a Turkish turban) consisting of the colours borne in the escutcheon, placed in an achievement between the helmet and the crest, and immediately supporting the crest.
- WREN**, in ornithology. See **MOTACILLA**.
- WRESTLING**, a kind of combat or engagement between two persons unarmed, body to body, to prove their strength and dexterity, and try which can throw his opponent to the ground. See **GAMES**, &c.
- WREXHAM**, a market-town of Denbighshire, in Wales, situated twenty-three miles south east of St. Asaph.
- WRINTON**, a market-town of Somersetshire, situated seven miles north of Wells.
- WRIST**, in anatomy. See **ANATOMY**, p. 179.
- WRIT**, in law, signifies, in general, the king's precept in writing under seal, issuing out of some court, directed to the sheriff, or other officer, and commanding something to be done in relation to a suit or action, or giving commission to have the same done.
- WRITING**, the art or act of signifying and conveying our ideas to others, by letters, or characters, visible to the eye. See **COMPOSITION**, **GRAMMAR**, and **LANGUAGE**.
- WRONG**, in a logical sense. See **ERROR**, **FALSEHOOD**, **TRUTH**, &c.
- WRONG**, in a legal sense, the same with injury, or tort.
- WRONGOUS Imprisonment**, in Scots law. See **LAW**, Tit. xxxiii. 23.
- WURTEMBERG**, in Germany, is the north part of the circle of Swabia.
- WURTZBURG**, a city of Germany in the circle of Franconia, capital of the bishopric of that name, situated on the river Main: in E. long.  $9^{\circ} 50'$ , N. lat.  $49^{\circ} 45'$ .
- WYE**, a market-town of Kent, situated twenty miles south-east of Maidstone.
- WYE** is also a river of Wales, which, rising on the confines of Cardiganshire, and running south east, divides the counties of Radnor and Brecknock; then crossing Herefordshire it turns south, and falls into the mouth of the Severn at Chepstow.



## X.

### X A N

- XACA**, a port-town of Sicily in the province of Mazara, forty miles south of Palermo: E. long.  $13^{\circ}$ , N. lat.  $37^{\circ}$ .
- XALISCO**, a city of Mexico, in America, situated near the Pacific ocean, four hundred miles west of the capital city of Mexico: W. long.  $110^{\circ}$ , and N. lat.  $22^{\circ} 20'$ .
- XANSI**, a province of China, bounded by the province of Peking on the east, by the great wall on the north, by the province of Honan on the south, and by the river Crocei, which divides it from the province of Xensi, on the west.
- XANTHIUM**, in botany, a genus of the monœcia pentandria class. The common calix of the male is imbricated;

### X A V

- the corolla is funnel shaped, and divided into five segments; and the receptacle is paleaceous: The calix of the female consists of two leaves, including two flowers; it has no corolla; the drupa is dry, mucicated, and divided into two segments; and the nucleus has two cells. There are three species, only one of them, *viz.* the strumarium, or lesser burdock, a native of Britain.
- XANTUM**, a province of China, in Asia, bounded by the Kang sea on the north, by the gulf of Nankin on the east, by the province of Nankin on the south, and by the province of Peking on the west.
- St. XAVIER**, a town of the province of La Plata, or Guayrá, in South America, situated on the confines of Brasil,

fil. two hundred miles west of Rio Janeiro: W. long. 50°, S. lat. 24°.

**XENSI** a province of China, bounded by the great wall on the north, by the province of Xanfi on the east, by the province of Suchuen on the south, and by Tibet on the west.

**XERANTHEMUM**, in botany, a genus of the syngenesia polygamia superflua class. The receptacle is paleaceous; the pappus is setaceous; and the calix is imbricated, and radiated. There are eleven species, none of them natives of Britain.

**XEROPHAGIA**, in church-history, the eating of dried foods: so the ancient Christians called certain fast days, on which they eat nothing but bread and salt, and drank only water; sometimes they added pulse, herbs, and fruits. This sort of fasting was observed chiefly in the holy-week, out of devotion, and not by obligation.

**XICHU**, a city of China, in the province of Huguam: E. long. 112°, N lat. 27°.

**XINYAN**, a city of Asia, in the province of Laotung: E. long. 120°, N lat. 31°.

**XIPHIAS**, in ichthyology, a genus belonging to the order of apodes. The upper jaw terminates in a long sword-shaped rostrum; from which it is called the sword-fish: there are no teeth in the mouth; the gill-membrane has eight rays; and the body is somewhat cylindrical. There is but one species, found in the European ocean.

**XIPHOIDES**, in anatomy. See ANATOMY, p. 175.

**XYLO-ALOES**, or **ALOE-WOOD**. in pharmacy. See **ALOE**.

This drug is distinguished into three sorts, the calambac, the common lignum aloes, and calambour.

The calambac, or finest aloes-wood, called by authors lignum aloes præstantissimum, and by the Chinese tuk hiang, is the most resinous of all the woods we are acquainted with: it is of a light spongy texture, very porous, and its pores so filled up with a soft and fragrant resin, that the whole may be pressed and dented by the fingers like wax, or moulded about by chewing in the mouth, in the manner of ma'ich. This kind, laid on the fire, melts in great parts like resin, and burns away in a few moments, with a bright flame and perfumed smell. Its scent, while in the mass, is very fragrant and agreeable; and its taste acrid and bitterish, but very aromatic and agreeable: it is so variable in its colour, that some have divided it into three kinds, the one variegated with black and purple; the second, with the same black, but with yellowish instead of purple; and the third, yellow alone, like the yolk of an egg: this last is the least scented of the three; the substance however, in them all, is the same in every respect, except their colour. It is brought from Cochinchina.

The lignum aloes vulgare is the second in value. This is of a more dense and compact texture, and consequently less resinous than the other; there is some of it, however, that is spongy, and has the holes filled up with the right resinous matter; and all of it, when good, has veins of the same resin in it. We meet with it in small fragments, which have been cut and split from larger; these are of a tolerably dense texture in the more solid pieces, and of a dusky brown colour, variegated with resinous black veins. It is in this state very heavy, and less fragrant than in those pieces which shew a multitude

of little holes, filled up with the same blackish matter that forms the veins in others. The woody part of these last pieces is somewhat darker than the other, and is not unfrequently purplish, or even blackish. The smell of the common aloes-wood is very agreeable, but not so strongly perfumed as the former. Its taste is somewhat bitter and acrid, but very aromatic. This wood is also brought from Cochinchina, and sometimes from Sumatra.

The calambour, or, as some write it, calambouc is also called agalochum sylvestre, and lignum aloes mexicanum. It is a light and friable wood, of a dusky and often mottled colour, between a dusky green black, and a deep brown. Its smell is fragrant and agreeable, but much less sweet than that of either of the others; and its taste bitterish, but not so much acrid or aromatic as either of the two former. We meet with this very frequent, and in large logs; and these sometimes entire, sometimes only the heart of the tree, the cortical part being separated. This is brought from the island of Timor, and is the aloes-wood used by the cabinet-makers and inlayers.

The Indians use the calambac by way of incense, burning small pieces of it in the temples of their gods; and sometimes their great people burn it in their houses, in times of feasting. It is esteemed a cordial, taken inwardly; and they sometimes give it in disorders of the stomach and bowels, and to destroy worms. A very fragrant oil may be procured from it, by distillation; which is recommended in paralytic cases, from five to fifteen drops. It is at present, however, but little used; and would scarce be met with any where in the shops, but that it is an ingredient in some of the old compositions.

**XYLO-BALSAMUM**, a name which naturalists give to the wood of the tree which yields that precious gum known to the Luns by the name of opobalsamum, and to us by the balm of Gilead. See **BALSAM**.

We have branches of this tree brought us from Cairo: they are very brittle, brittle, unequal, and full of knots; their bark reddish without, and greenish within. The xylo-balsamum is reputed good to strengthen the brain and stomach, and to expel poison.

**XYLOCASIA**, in the materia medica, the same with the cassia ligna. See **CASSIA**.

**XYLON**, the **PRICKLY COTTON-TREE**, in botany, a genus of the polyandria monogynia class of plants, the corolla whereof consists of a single petal, divided into five oval, hollow, patent segments: the fruit is a large, oblong, turbinated capsule, formed of five woody valves, and containing five cells; the seeds are roundish, and fixed to a columnar pentagonal receptacle, and have a quantity of fine down, or cotton, adhering to them.

**XYNOECIA**, in Grecian antiquity, an anniversary feast, observed by the Athenians, in honour of Minerva, upon the sixteenth of Hecatombæon, in memory that, by the persuasion of Theseus, they left their country-seats, in which they lay dispersed here and there in Attica, and united together in one body.

**XYRIS**, in botany, a genus of the triandria monogynia class. The corolla consists of three equal crepated petals; and the gluma consists of two valves. There is but one species, a native of India.

**XYSTARCHA**, in antiquity, the master or director of the xystus. In the Greek gymnasium, the xystarcha was the

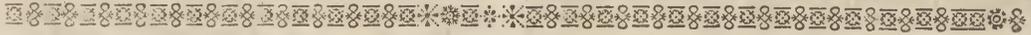
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second officer, and the gymnasiarcha the first; the former was his lieutenant, and presided over the two xylii, and all exercises of the athletæ therein.

**XYSTUS**, among the Greeks, was a long portico, open or covered at the top, where the athletæ practised wrestling

and running: the gladiators, who practised therein, were called xyfici.

Among the Romans, the xystus was only an alley, or double row of trees, meeting like an arbour, and forming a shade to walk under.



## Y.

## Y A W

**YACHT**, or **YATCH**, a vessel with one deck, carrying from four to twelve guns. See **SHIP**.

**YARD**, a measure of length used in Britain and Spain, consisting of three feet, chiefly to measure cloth, stuffs, &c.

**YARD**, in anatomy: See **ANATOMY**, p. 270.

**YARDS of a ship**, are those long pieces of timber which are made a little tapering at each end, and are fitted athwart its proper mast, with the sails made fast to them, so as to be hoisted up, or lowered down, as occasion serves. They have their names from the masts unto which they belong.

**YARD-ARM** is that half of the yard that is on either side of the mast, when it lies athwart the ship.

**YARDS** also denote places belonging to the navy, where the ships of war, &c. are laid up in harbour. There are, belonging to his majesty's navy, six great yards, *viz.* Chatham, Deptford, Woolwich, Portsmouth, Sheerness, and Plymouth: these yards are fitted with several docks, wharfs, lanches, and graving places for the building, repairing, and cleaning of his majesty's ships; and therein are lodged great quantities of timber, masts, planks, anchors, and other materials: there are also convenient store-houses in each yard, in which are laid up vast quantities of cables, rigging, sails, blocks, and all other sorts of stores needful for the royal navy.

**YARE**, among sailors, implies ready or quick: as, be yare at the helm; that is, be quick, ready, and expeditious at the helm. It is sometimes also used for bright by seamen: as, to keep his arms yare; that is, to keep them clean and bright.

**YARE**, a river of Norfolk, which runs from west to east, through that country, passing by Norwich, and falling into the German sea at Yarmouth.

**YARMOUTH**, a borough and port town of Norfolk, situated on the German sea, at the mouth of the river Yare, twenty miles east of Norwich. It sends two members to parliament.

**YARMOUTH** is also a borough-town of the Isle of Wight, in Hampshire, situated on the north-west coast of the Island, six miles west of Newport. It sends two members to parliament.

**YARN**, wool or flax spun into thread, of which they weave cloth. See **CLOTH**.

**YARUM**, a market-town of the north riding of Yorkshire, situated on the river Tees, thirty miles north of York.

**YAWNING**, an involuntary opening of the mouth, occa-

## Y E O

sioned by a vapour or ventosity endeavouring to escape, and generally witnessing an irksome weariness, or an inclination to sleep. Yawning, according to Boerhaave, is performed by expanding at one and the same time all the muscles capable of spontaneous motion; by greatly extending the lungs; by drawing in gradually and slowly a large quantity of air; and gradually and slowly breathing it out, after it has been retained for some time, and rarified; and then restoring the muscles to their natural state. Hence the effect of yawning is to move, accelerate, and equally distribute all the humours through all the vessels of the body, and consequently to qualify the muscles and organs of sensation for their various functions.

Sanctorius observes, that a great deal is insensibly discharged, when nature endeavours to get rid of the retained perspirable matter, by yawning and stretching of the limbs. To these a person is most inclined just after sleep, because, a greater quantity going off by the pores of the skin than at other times, whensoever a person wakes, the increased contraction that then happens closes a great deal of the perspirable matter in the cutaneous passages, which will continually give such irritations as excite yawning and stretching; and such motions, by shaking the membranes of the whole body, and shifting the contacts of their fibres, and the inclosed matter, by degrees throw it off. Hence we see the reason why healthful strong people are most inclined to such motions, because they perspire most in time of sleep, and therefore have more of the perspirable matter to lodge in the pores, and greater irritations thereunto.

**YAWS**, in the sea language A ship is said to make yaws, when she does not steer steady, but goes in and out when there is a stiff gale.

**YAWS**, a distemper endemial to Guinea and the hotter climates in Africa. See **MEDICINE**, p. 137.

**YEAR**. See **ASTRONOMY**, p. 489.

**YEAR and Day** in Scots law. See **LAW**, Tit. vi. 21, 22.

**YELLOW**, one of the original colours of light.

**YELLOWs**, a disease in a horse, much the same with that called the jaundice in man. See **FARRIERY** p. 561.

**YELLOW-HAMMER**, in ornithology. See **FRINGILLA**.

**YEOMAN**, the first or highest degree among the plebeians of England, next in order to the gentry.

The Yeomen are properly freeholders, who having land of their own, live on good husbandry

**YEOMAN** is also a title of office in the king's household, of a middle place or rank between an usher and a groom.

**YEOMAN**

**YEOMEN** of the guard were anciently two hundred and fifty men of the best rank under gentry, and of larger stature than ordinary, each being required to be six feet high.

At present there are but one hundred yeomen in constant duty, and seventy more not in duty; and as any of the hundred dies, his place is supplied out of the seventy.

They go dressed after the manner of king Henry VIII's time. They formerly had diet as well as wages when in waiting, but this was taken off in the reign of queen Anne.

**YEOVIL**, a market-town of Somersetshire, situated eighteen miles south of Wells.

**YEST**, a head or scum rising upon beer or ale, while working or fermenting in the vat. See **BREWING**.

It is used for a leaven or ferment in the baking of bread, as, serving to swell or puff it up very considerably in a little time, and to make it much lighter, softer, and more delicate.

**YEW**, in botany. See **TAXUS**.

**YLA**, one of the western islands of Scotland, situated in the Irish-sea, west of Cantire.

**YNCA**, an appellation anciently given to the kings of Peru, and the princes of their blood; the word literally signifying lord, king, emperor, and royal blood.

**Y Oak**, or **Yoke** in agriculture, a frame of wood, fitted over the necks of oxen, whereby they are coupled together, and harnessed to the plough.

**Y oak of land** in our ancient customs, was the space which a yoke of oxen that is, two oxen, may plow in one day.

**Sea Y oak**. When the sea is so rough that the helm cannot be governed by the hands, the seamen make a yoke to steer by; that is, they fix two blocks to the end of the helm, and receive two small ropes through them,

which they call falls, by having some men at each tackle, they govern the helm by direction. They have another way of making a sea yoke, by taking a double turn about the end of the helm with a single rope, the ends being laid to the ship's sides, by means whereof they guide the helm.

**YOANGFU**, a city of China, in the province of Huguam, situated on the river Kiam E. long. 114°, N. lat. 20° 40'.

**YOLK**, the yellow part in the middle of an egg. See **EGG**.

**YONNE**, a river in France, which rising in Burgundy, and running north through Nivernois and Champagne, falls into the Seine at Montereau sur Yonne.

**YORK**, the capital city of Yorkshire, situated on the river Ouse, 180 miles north of London: W. long. 50', N. lat. 54°. It is a large city, and has some good buildings in it, particularly the cathedral, which is a Gothic pile, equal to any thing of the kind in England. It is the see of an archbishop, and sends two members to parliament.

**New YORK**, one of the British colonies in North America, which comprehending the Jerseys, that frequently have the same governor. is situated between 72° and 74° of W. long. and between 41° and 44° of N. lat. bounded by Canada on the north, New England on the east, the American Sea on the south, and Pensilvania and the country of the Iroquois on the west.

**New YORK**, the capital city of this province, is situated on an island in the mouth of Hudson's river, in W. lon. 72° 20', N. lat. 41°

**YUCCA**, in botany, a genus of the hexandria monogynia class. The corolla is open and bell-shaped; it has no stylus; and the capsule has three cells. There are four species, all natives of America.

A kind of bread is made from the dried root of this plant by the Indians, which much resembles that made from the root of the cassia or scutellaria of **Linnaeus**.

## Z.

### Z A M

### Z A N

**Z AARA**, one of the divisions of Africa, situated under the tropic of cancer, is bounded by Bildulgerid on the north, by the unknown parts of Africa on the east, by Nigritia or Negroland on the south, and by the Atlantic ocean on the west. This is a barren desert, and so destitute of water, that the camels which pass over it from Morocco to traffic with Negroland, are half loaded with water and provisions.

**ZAFFER**, or **ZAFRE**, in chemistry, the name of a blue substance, of the hardness and form of a stone; and generally supposed to be a native fossil.

It is in reality, however, a preparation of cobalt; the calx of that mineral being mixed with powdered flints and wetted with water to bring it into this form.

**ZAMORA**, a city of Spain, in the province of Leon, situated on the river Douro, thirty-two miles north of Salamanca: W. long. 6°, N. lat. 41° 30'.

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3.

**ZANGUEBAR**, a country on the east coast of Africa, situated in southern latitude between the equator and the tropic of capricorn, being bounded by the country of Anian on the north, by the Indian ocean on the west, by Caffraria on the south, and by the unknown parts of Africa on the west.

**ZANNICHELLIA**, in botany, a genus of the monœcia monandria class. The male has neither calix nor corolla. The calix of the female consists of one leaf; it has no corolla; and there are four germina, and as many seeds. There is but one species, viz. the palustris, or horned pond-weed, a native of Britain.

**ZANONIA**, in botany, a genus of the diœcia pentandria class. The calix of both male and female consists of three leaves, and the corolla of five segments; the female has three styli; and the berry contains two seeds. There is but one species. a native of Malabar.

9 D

ZANTE,

**ZANTE**, an island in the Mediterranean sea, situated E. long.  $21^{\circ} 30'$ , N. lat.  $37^{\circ} 50'$ , being about twenty four miles long, and twelve broad. The chief town is Zant, and is situated on the east side of the island, being well fortified and defended by a castle.

**ZAPATA**, a kind of feast or ceremony held in Italy, in the courts of certain princes, on St Nicholas's day; wherein people hide presents in the shoes or slippers of those they would do honour to, in such a manner as may surprize them on the morrow when they come to dress; being done in imitation of the practice of St Nicholas, who used in the night-time to throw purses of money in at the windows, to marry poor maids withal.

**ZARA**, a city of Dalmatia, situated on the gulph of Venice: E. long.  $17^{\circ}$ , N. lat.  $44^{\circ}$ .

**ZARNAW**, a city of Poland, in the province of Little Poland and palatinate of Sandomir, situated E. long.  $20^{\circ}$ , N. lat.  $51^{\circ} 30'$ .

**ZEAL**, INDIAN CORN, in botany, a genus of the monoecia triandria class. The calix of the male is a double flowered glume, without any awn; the corolla is likewise a glume, without any awn; the calix and corolla of the male consists each of two valves; the stylus is filiform, and pendulous; and the seeds are solitary, being sunk in an oblong receptacle. There is but one species, a native of America.

**ZEAL**, the exercise of a warm animated affection, or passion, for any thing.

**ZEALAND** the chief of the Danish islands, is situated at the entrance of the Baltic-sea, bounded by the Schagger-rac-sea on the north; by the Sound, which separates it from Schonen, on the east; by the Baltic-sea, on the south; and by the strait called the Great Belt, which separates it from the island of Funen, on the west; being of a round figure. near two hundred miles in circumference: the chief town is Copenhagen.

**ZEALAND**, is also a province of the United Netherlands, consisting of eight islands, which lie in the mouth of the river Scheld, bounded by the province of Holland, from which they are separated by a narrow channel, on the north; by Brabant, on the east; by Flanders, from which they are separated by one of the branches of the Scheld, on the south; and by the German ocean, on the west.

**ZEALOTS**, an ancient sect of the Jews, so called from their pretended zeal for God's law, and the honour of religion.

**ZEBRA**, in zoology. See EQUUS

**ZECHARIAH**, a canonical book of the Old Testament, containing the predictions of Zechariah, the son of Barachia, and grandson of Iddo. He is the eleventh of the twelve lesser prophets. Zechariah entered upon the prophetic office at the same time with Haggai, and was sent to the Jews upon the same message, to reprove them for their backwardness in erecting the temple, and restoring divine worship; but especially for the disorder of their lives and manners, which could not but derive a curse upon them. By several notable visions and types, he endeavours to confirm their faith, and establish their assurance concerning God's providence with them, and care over them; and as a proof and demonstration of this, he interperes the most comfortable promises of the coming of the kingdom, the temple, the priesthood, the victory, the glory of Christ the Branch. Nor does he for-

get to assure them of the ruin of Babylon, their most implacable enemy. This prophet is the longest and most obscure of all the lesser prophets, his style being interrupted and without connection.

**ZEDOARY**, in the materia medica, a root, the several pieces of which differ so much from one another in shape, that they have been divided into two kinds, as if two different things, under the names of the long and round zedoary, being only the several parts of the same root.

Zedoary is to be chosen fresh, found, and hard, in large pieces; it matters not as to shape, whether long or round; of a smooth surface, and of a sort of fatty appearance within, too hard to be bitten by the teeth, and of the briskest smell that may be; such as is friable, dusty, and worm eaten, is to be rejected.

Zedoary, both of the long and round kind, is brought us from China; and we find by the Arabians, that they also had it from the same place. The round tubera are less frequent than the long, and some of them have therefore supposed them the produce of a different and more rare plant; but this is not so probable as that the general form of the root is long, and the round tubera are only *lusus naturæ*, and less frequent in it.

Zedoary, distilled with common water, affords a thick and dense essential oil, which soon concretes of itself into a kind of camphor, and on this oil its virtues principally depend. It is a sudorific, and is much recommended by some in fevers, especially of the malignant kinds. It is also given with success as an expectorant in all disorders of the breast, arising from a tough phlegm, which it powerfully incides and attenuates; it is also good against flatulences, and in the cholick; it strengthens the stomach, and assists digestion; and, finally, is given with success in nervous cases of all kinds.

**ZELL**, a city of Germany, in the circle of Lower Saxony, capital of the duchies of Zell and Lunenburg, situated at the confluence of the rivers Aller and Fuhse, thirty miles north of Hanover, and forty south of Lunenburg: E. long.  $10^{\circ}$ , N. lat.  $52^{\circ} 52'$ .

**ZEND**, or **ZENDAVESTA**, a book containing the religion of the Magians, or worshippers of fire, who were disciples of the famous Zoroaster. See MAGI.

This book was composed by Zoroaster during his retirement in a cave, and contained all the pretended revelations of that impostor. The first part contains the liturgy of the magi, which is used among them in all their oratories and fire-temples to this day; they reverence it as the Christians do the Bible, and the Mahometans the Koran. There are found many things in the zend taken out of the scriptures of the Old Testament, which Dr. Prideaux thinks is an argument that Zoroaster was originally a Jew. Great part of the Psalms of David are inserted: he makes Adam and Eve to have been the first parents of mankind, and gives the same history of the creation and deluge as Moses does, and commands the same observances about clean and unclean beasts, the same law of paying tythes to the sacerdotal order, with many other insinuations of Jewish extraction. The rest of its contents are an historical account of the life, actions, and prophecies of its author, with rules and exhortations to moral living. The Mahometans have a sect which they call Zendikates, who are said to be the Sadducees of Mahometanism, denying providence and the resurrection, believing

lieving the transmigration of souls, and following the zend of the magi.

**ZENITH**, in astronomy, the vertical point; or a point in the heavens directly over our heads.

**ZEPHANIAH**, a canonical book of the Old Testament, containing the predictions of Zephaniah the son of Cushi, and grandson of Gedaliah; being the ninth of the twelve lesser prophets. He prophesied in the time of king Josiah, a little after the captivity of the ten tribes, and before that of Judah; so that he was co-temporary with Jeremiah. He freely publishes to the Jews, that what increased the divine wrath against them, was their contempt of God's service, their apostasy, their treachery, their idolatry, their violence and rapine, and other enormities: such high provocations as these rendered their destruction terrible, universal, and unavoidable: and then, as most of the prophets do, he mingles exhortations with repentance, as the only expedient in these circumstances.

**ZEPHYR**, the west wind, or that which blows from the cardinal point of the horizon opposite to the east.

**ZEST**, the woody thick skin, quartering the kernel of a walnut; prescribed by some physicians, when dried and taken with white-wine, as a remedy against the gravel.

**ZETETIC METHOD**, in mathematics, the method made use of to investigate or solve a problem.

**ZUGMA**, a figure in grammar, whereby an adjective or verb which agrees with a nearer word, is also, by way of supplement, referred to another more remote.

**ZEUS**, in ichthyology, a genus belonging to the order of thoracici. The head is compressed, and declines, the upper lip being vaulted over by a transverse membrane; the tongue is subulated; there are seven rays in the gill membrane; and the body is compressed. The species are four, distinguished by the shape of their tails.

**ZFBRETHICUS**, in zoology. See **CASTOR**.

**ZINGIBER**, in botany. See **AMOMUM**.

**ZINK**. See **CHEMISTRY**, p. 90, 106, 143.

**ZINZIBER**, or **ZINGIBER**, **GINGER**, in botany, the naked stalked oval spiked amomum. See **AMOMUM**, and **GINGER**.

**ZIRANIA**, in botany a genus of the monoecia hexandria class. The male has no calix; the corolla consists of a double valved glume without any awn. The female has no calix; the corolla consists of a single-valved guma with an awn; the stylus is bifid; and there is but one seed. The species are two, none of them natives of Britain.

**ZIZIPHORA**, in botany, a genus of the diandria monogynia class. The corolla is ringent the superior lobe being reflexed and entire; the calix is filiform; and there are four seeds. The species are four, none of them natives of Britain.

**ZODIAC** in astronomy, a fascia or broad circle, whose middle is the ecliptic and its extremes two circles parallel thereto; at such a distance from it as to band or comprehend the excursions of the sun and planets. See **ASTRONOMY**.

**ZOLLERN**, a city of Germany, in the circle of Swabia, capital of the county of Zoilern, and subject to its count: situated E. long. 8° 55', N. lat. 48° 18'.

**ZONE**, in geography and astronomy, a division of the terraqueous globe, with respect to the different degrees of heat found in the different parts thereof. See **GEOGRAPHY**.

**ZOOLOGY**, the science of animals. See **NATURAL HISTORY**.

**ZOOPLHIT**, in natural history, a kind of intermediate body, partaking of the nature of a sensitive and a vegetable. See **NATURAL HISTORY**.

**ZOOTOMY**, the art of dissecting animals or living creatures, being the same with anatomy. See **ANATOMY**.

**ZUG**, one of the cantons of Switzerland, is surrounded by the cantons of Lucern, Zurich, and Switz; and is eighteen miles long, and seven broad.

**ZUINGLIANS**, a branch of the ancient Christian reformers, or protestants; so called from their author Huldric Zuinglius, a divine of Switzerland, who soon after Luther had declared against the church of Rome; and being then minister of the church at Zurich, fell in with him, and preached openly against indulgences, the mass, the celibacy of the clergy, &c. What he differed from Luther in, concerned the eucharist: for interpreting *hoc est corpus meum*, by *hoc significat corpus meum*, he maintained that the bread and wine were only significations of the body and blood of Jesus Christ; whereas Luther held a consubstantiation.

**ZURICH**, a canton of Switzerland, bounded by the canton of Schaffhausen on the north, by the canton of Appenzel on the east, by Zug and Switz on the south, and by Bern and Lucern on the west; being fifty miles long, and forty broad. Zurich is also the name of the capital city of this canton, situated E. long. 8° 30', and N. lat. 47° 52'. It is likewise the name of a lake, twenty-four miles long, and three broad; at the south end of which the city of Zurich stands.

**ZUTPHEN**, a city of a county of the same name, in Gelderland, situated on the river Yssel, sixteen miles north-east of Arnheim: E. long. 6°, N. lat. 52° 15'.

**ZUYDERSEE**, a great bay of the German ocean, which lies in the middle of the United provinces, having the islands of Texel, Flie, and Schelling, at the entrance of it, on the north; the provinces of Friesland, Overijssel, and Gelderland, on the east; Utrecht, and part of Holland, on the south; and another part of Holland on the west. The chief town is Amsterdam.

**ZWEIBRUGGEN**, a county of the palatinate of the Rhine, in Germany, subject to the duke of Deuxponts.

**ZYGÆNA**, in ichthyology. See **SQUALUS**.

**ZYGOMA** in anatomy. See **ANATOMY**, p. 152.

**ZYGOMATICUS**, in anatomy. See **ANATOMY**, p. 306.

**ZYGOPHYLLUM**, in botany, a genus of the decandria monogynia class. The corolla consists of five leaves and the corolla of five petals; the nectarium consists of ten leaves, covering the germen, and the capsule has five cells. There are 8 species, none of them natives of Britain.

C O R R I G E N D A.

Page 132. col. 1. l. 25, 26. Instead of *from the salivary glands, from smoking, &c.* read, *as to the salivary glands from smoking, &c.* METAPHYSICS, l. 10. For *metaphysics*, read *physics*.  
 P. 588. col. 2. l. ult. Instead of *which is always really a diphthong*, read, *which is always, when long, really a diphthong*.  
 P. 510. col. 2. l. ult. For (*ibid.* n<sup>o</sup> 2.) read (Plate CXLVII. fig. 1. n<sup>o</sup> 1.) P. 590. col. 1. l. 41. For *curve line*, read *curvilinear*.

N O T A N D A

1. In the Table of ERRATA at the end of Vol. I. it was said, "That Plate XLVII. represented a different Orrery from the one described." This was a mistake the Printer was somehow led into: for the Orrery there represented is the right one, and corresponds with the description.
2. In FLAX-DRESSING, plans of two machines relating to that article were referred to, but which several circumstances now render it difficult for the Editors to give. It is therefore hoped these will be dispensed with, as they are not of the most general importance, and the article is sufficiently explained and illustrated without them; and especially as 10 plates more than the proposed number, and 16 pages of letter-prefs, are given gratis.

D I R E C T I O N S to the B I N D E R.

1. Be careful in cutting the book, not to pare too much off the margin; as it was necessary, in several places, particularly in BOOK-KEEPING, to enlarge the page beyond the measure of the rest of the book.
2. Title-pages for the Three Volumes are printed. Place them respectively at the beginning of the Volume; and after the title in Vol. I. insert the Preface.
3. In BOOK-KEEPING, Vol. I. cancel pages 585, 586; and in their place insert the leaves marked with an asterisk and inclosed with parenthesis, viz. (\*585) (\*586), (\*A) (\*A), (\*B) (\*B), (\*C) (\*C), (\*D) (\*D), (\*E) (\*E).
4. Insert the Plates as directed below.

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23	—	336	62	—	24	103	—	880	142		476
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28	}	354	67	—	270	106	—	42	147		512
29			68	—	414	07	—	46	148		535
30	}	357	69	—	422	108	—	50	149		
31			70	—	416	109	—	56	150		
32	}	358	71	—	428	110	—	172	151		592
33			72	—	440	111	—	266	152		
34	}	359	73	—	475	112	—	215	153		
35			74	—	477	113	—	221	154		598
36	}	360	75	—	506	114	—	155			
37			76	—	540	115	—	316	156		613
38	}	425	77	—	541	116	—	157			678
39			78	—	583	117	—	158			
40	}	444	79	—	585	118	—	352	59		912
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