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CHEMICAL ESSAYS.
No. II.

CALORIC CONTINUED—ELECTRICITY.

WE have before observed, that caloric has the power of expanding all bodies. This expansion varies exceedingly in the various substances upon which it acts. Different metals expand in different degrees. To shew these variations, instruments called pyrometers have been invented. Upon this principle, thermometers have been formed: they are tubes with a bulb at the bottom; the air is excluded from them, and some liquid (generally spirits of wine or mercury) is introduced into the bulb, which by its expansion or contraction, measured by a scale affixed to the tube, shews the temperature of the bodies with which it is brought into contact.

The most important powers then of free caloric, to which we have alluded, are its tendency to an equilibrium, its power of radiation, of expansion, and of conducting. We will now pass on to examine our second modification of caloric; namely *specific* or *combined caloric*. The study of this part of heat we may subdivide into two branches: first, the specific heat of bodies while they retain the same state; second, the heat connected with or developed by a change of state.

The specific heat of a body is that which is as it were imprisoned in it: for the only heat we can feel is the free caloric with which it parts, consequently the thermometer can form no test for the specific heat of bodies. *The quantity of heat required to* raise different bodies an equal number of thermometric degrees, is quite different. If, for instance, we take water, alcohol, mercury,* and oil, and heat them in tin vessels by the heat of an oven, we shall find that they will not all arrive at any given point of heat at the same time. The oil will be the last to acquire the temperature, the alcohol next, and then the water; the mercury will first reach it. Nor can this arise from the different conducting powers of the various fluids: for if they are now all poured into water of the same temperature, (when they will give out all the caloric they have absorbed,) it will be found that the oil will heat the water most, and so on in succession; thus clearly shewing that different bodies have different *capacities* for caloric.

But we will now proceed to our second division of specific heat: the heat connected with or developed in the changes of state. This is generally called *latent heat.* The sudden changes of bodies from a solid to a liquid, and from a liquid to a gaseous or aeriform state, and the reverse of these, give the body new capacities for caloric. In the changing of ice into water, great heat is absorbed; this becomes latent in the newly formed liquid. In the same way, to carry on the experiment, when water is boiled, it does not rise

* Mercury was anciently called quicksilver, from its resemblence to silver. The name is not yet quite laid aside.

in temperature after it has once reached the boiling point, because the additional heat it acquires is employed in changing the water into steam, and becomes *latent heat* in the newly formed vapour. On the other hand, the latent heat of a liquid may be made *sensible*, by any method which we can adopt for solidifying it: for it may be remarked, (though with several exceptions,) that the more *solid bodies have frequently less* capacity for caloric than others which are less solid. If we mix sulphuric acid and water, we shall find, that sufficient heat is evolved to raise the thermometer considerably above the boiling point. The cause of this is, as we before saw, that through some disposition of chemical affinity, the particles of the acid and the water enter into composition in a much more *solid* form, the *capacity* for caloric is diminished, and that which was *latent heat* in its less condensed form, is now sensible, or free caloric, becoming sensible as it is evolved. Another example may be found in the slaking of quicklime. The heat which is here produced, arises from the water and the lime entering into a more solid form; and the *capacity* for caloric being lessened, the latent heat of the water is evoloved, and becomes sensible. There is one more striking instance of the effect produced by the demand for caloric to be converted into latent heat; namely, in the cold produced by evaporation. This is very great in the evaporation of spirits of wine, ether, and other fluids which evaporate quickly. Here the caloric is absorbed by the spirits of wine, when converted into a state of vapour, to exist in the vapour in the shape of latent heat. In very hot climates, the cold produced is so intense, that a large animal may be actually killed by the frequent application of either to his body. In India, ice is produced during the night, by evaporating water in large and very shallow vessels, so that a large surface shall be exposed to the air.

We have now discussed the subject of heat, or caloric. Its *chief* chemical use is as a *solvent*. As water destroys the attraction of cohesion by introducing its particles between the particles of the body acted upon, so fire acts with regard to many bodies which are not acted upon by water. Caloric introduces its particles, and thus renders the body more liable to be acted upon by other chemical operations.

We will now advert to our last general power, *electricity*; and here we must content ourselves with a mere cursory and popular view of the subject, as it would carry us to a far greater length than our limits will admit, were we to attempt to enter into its more abstruse speculations.

If we rub with a dry hand, or with a silk handkerchief, a glass tube, and then bring it near to bits of paper, cotton, or, which is better, gold-leaf, it will first attract these bodies, and then repel them. If when the atmosphere is dry, we take a glass rod in one hand, and a stick of sealing-wax in the other, and having rubbed one of them, approach it to a bit of gold-leaf floating in the air, it will repel, and then attract it: if while the one repels it, we rub the other, and approach it to the particle, it will attract it; and thus you may proceed for any length of time, *alternately repelling and attracting.*

Such are some of the phenomena of this fluid in its weakest state: when collected in larger quantities by instruments which we shall hereafter describe, it appears as a spark. As for its operations, almost all the minute changes as well as the grander luminous appearances of matter, seem to originate in it.

There are several substances, such as glass and sealing-wax, which, by friction or other methods, seem to acquire an increased quantity of the electric matter from the atmosphere. We will mention some of these in the order in which they naturally occur, placing the more powerful bodies at the head of the list, and decreasing gradually to the close.

1 SHELL LAC.	7. GLASS, and all vitrified bodies containing diamonds, and crystallized transparent minerals.
2. AMBER.	8. RAW SILK.
3. RESINS.	9. PAPER.
4. SULPHUR.	10. BAKED WOODS, &c.
5. WAX.	
6. ASPHALTUM	

On the other hand, there are certain substances which do not partake in the least of the power to which we have just alluded, but which favour the distribution of electricities when they are acquired. Among these we may rank first the metals. The following is a list of a few of the best *conductors* of electricities, as these are termed, in opposition to the former class, which are termed *electrics*, and *non-conductors*.

1. Copper.	3. Gold.	5. Tin.
2. Silver.	4. Iron.	6. Lead, &c.
7. Charcoal.	10. Ice & snow, above 0°	13. Vapour.
8. Dilute Acids.	11. Living Animals.	14. Dry Earths, &c.
9. Water.	12. Smoke.	

But not to enter at present more at large upon this part of our subject, which would well merit a particular lecture, we will pass on to galvanism, a branch of electricity more especially connected with chemistry. Galvani, a professor of natural philosophy of Bologna, discovered, that when a piece of any kind of metal was laid on the nerve of the leg of a recently killed frog, provided the nerve rested on some other metal, the leg suddenly moved on a communication being made between the two pieces of metal.* This was soon found to be effected by a fluid of the same nature as electricity. A mechanism was soon formed, by means of which this fluid might be collected. It is a trough of earthenware, with plates of zinc and copper soldered together in pairs, each pair being fixed at regular distances from each other, and the interstices filled with fluid; the best is acid diluted in water. By this means the electric fluid is produced, and carried on from one plate to another, till it reaches the extremity, where a wire made of platina receives it. The fluid evolved at the one wire is positive electricity, or the same as we before stated was obtained from glass; that at the other wire negative, answering to what was obtained from the friction of sealing-wax or resin.

There are two theories with regard to the cause of this: one, that it arises in some way from the contact of the zinc and copper; this is supported by Sir Humphrey Davy; the other is called the *chemical* explanation, which we will hear give.—According to this, the acid of the water *oxidizes** the zinc, and renders it unable to retain so much electricity as it had before. It accordingly gives it out to the fluid, which conducts it to the *opposite* plate of copper. Hence it passes to the succeeding plate of zinc, whence it is driven as before. The same action continues to the end.—The chief difference between the electricity we obtain by the common glass machine and the voltaic or galvanic battery, is, that the latter gives us the fluid in the most intense state, the former in the greatest quantity.

* Here, as before, regularity obliges us to defer the explanation of some of the terms which we are compelled to use. In the acid there is a certain part of the acid and of the water called oxygen. This has a great inclination to unite with all metals; but with some more than others. It lessens the *conducting* power of those with which it unites.

The method of explaining the action of the electrical machine, according to the theory just mentioned, is, that the amalgam* put on the latter, obtains from the atmosphere *oxygen* by friction.

We have thus cursorily noticed the powers and properties of matter, under the four heads of the attraction of cohesion, the chemical or heterogeneous attraction, caloric, and electricity.

PLURALITY OF WORLDS.

IT is truly a most Christian exercise, to extract a sentiment of piety from the works and the appearances of nature. It has the authority of the sacred writers upon its side, and even our Saviour himself gives it the weight and the solemnity of his example. *Behold the lilies of the field; they toil not, neither do they spin, yet your heavenly Father careth for them.* He expatiates on the beauty of a single flower, and draws from it the delightful argument of confidence in God. He gives us to see that taste may be combined with piety, and that the same heart may be occupied with all that is serious in the contemplations of religion, and be at the same time alive to the charms and the loveliness of nature.

The Psalmist takes a still more loftier flight. He leaves the world, and lifts his imagination to that mighty expanse which spreads above it and around it. Creation rises in its immensity before him, and the world, with all which it inherits, shrinks into littleness at a contemplation so vast and so overpowering. *What is man that thou art mindful of*

* Amalgam is a metallic compound formed of mercury, zinc and tin, with some oil or grease.

him, or the son of man that thou shouldest deign to visit him?

It seems to have been at night that the piety of the Psalmist was awakened by this contemplation; and there is much in the scenery of a nocturnal sky, to lift the soul to pious contemplation. The mind abandons itself to reverie, it sees nature in the simplicity of her great elements, and it sees the God of nature invested with the high attributes of wisdom and majesty.

But what can these lights be? We all know that every visible object appears less in magnitude as it recedes from the eye. The lofty vessel, as it retires from the coast, shrinks into littleness, and at last appears in the form of a small speck on the verge of the horizon. The eagle with its expanded wings, is a noble object; but when it takes its flight into the upper regions of the air, it becomes less to the eye, and is seen like a dark spot upon the vault of heaven. The same is true of all magnitude. The heavenly bodies appear small to the eye of an inhabitant of this earth, only from the immensity of their distance. When we talk of hundreds of millions of miles, it is not to be listened to as incredible. For remember that we are talking of those bodies which are scattered over the immensity of space, and that space knows no termination. The conception is great and difficult, but the truth is unquestionable. By a process of measurement, the distance has been first ascertained, and then the magnitude of some of those bodies which roll in the firmament; that the sun which presents itself to the eye under so diminutive a form, is really a globe exceeding, by many thousands of times, the dimensions of the earth which we inhabit; that the moon itself has the magnitude of a world; and that even a few of those stars, which appear like so many lucid points to the unassisted eye of the observer, expand into large circles upon the application of the telescope, and are some of them much larger than the ball which we tread upon, and to which we proudly apply the denomination of the universe.

The planetary system has its boundary. There are only five, or at most six, of the planetary orbs visible to the naked eye. What then is that multitude of other lights which sparkle in our firmament, and fill the whole concave of heaven with innumeral splendours? The planets are all attached to the sun; and in circling round him, they do homage to that influence which binds them to perpetual attendance on this great luminary. But the other stars do not own his dominion. They do not circle around him. To all common observation they remain immoveable; and each, like the independent sovereign of his own territory, appears to occupy the same inflexible position in the regions of immensity. What mean these innumerable fires lighted up in distant parts of the universe? Are they only made to shed a feeble glimmering over this little spot in the kingdom of nature? or do they serve a purpose worthier of themselves, to light up other worlds, and give animation to other systems?

The first thing which strikes a scientific observer of the fixed stars, is their immeasurable distance. If the whole planetary system were lighted up into a globe of fire, it would exceed, by many millions of times, the magnitude of this world, and yet only appear a small lucid spark from the nearest of them. If a body were projected from the sun with the velocity of a cannon-ball, it would take hundreds of thousands of years before it described the mighty interval which separates the nearest of the fixed stars.

from our sun and from our system. If this earth, which moves at more than the inconceivable velocity of a million and a half miles a-day, were to be hurried from its orbit, and to take the same rapid flight over this immense tract, it would not have arrived at the termination of its journey, after taking all the time which has elapsed, since the creation of the world. These are great numbers, and great calculations; and the mind feels its own impotency in attempting to grasp them. We can state them in words; we can exhibit them in figures; we can demonstrate them by the powers of a rigid and infallible geometry; but no human fancy can summon up a lively or an adequate conception—can take in this mighty space in all its grandeur and immensity—or lift itself up to the majesty of that great and invisible arm on which it is all suspended.

But what can these stars be which are seated so far beyond the limits of our planetary system? They must be masses of immense magnitude, or they could not be seen at the distance of place which they occupy. The light which they give must proceed from themselves, for the feeble reflection of light from some other quarter could not pervade through such mighty tracts to the eye of an observer. A body may be visible in two ways. It may be visible from its own light, as the flame of a candle, or the brightness of a fire, or the brilliancy of yonder glorious sun, which lightens all below, and is the lamp of the world. Or it may be visible from the light which falls upon it, as the body which thus receives its light from the taper—or the whole assemblage of objects on the surface of the earth, which appear only when the light of day rests upon them—or the moon, which, in that part of it that is towards the sun, gives out a silvery whiteness to the eye of the observer, while the other part forms a black and invisible space in the firmament—or as the planets, which shine only because the sun shines upon them, and which, each of them, present the appearance of a dark spot on the side that is turned away from it. Now apply this question to the fixed stars. Are they luminous of themselves, or do they derive their light from the sun, like the bodies of our planetary system? Think of their immense distance, and the solution of this question becomes evident. The sun, like any other body, must dwindle into a less apparent magnitude as you retire from it. At the prodigious distance of the fixed stars, it must have shrunk into a small indivisible point. In short, it must have become a star itself, and could shed no more light than a single individual of those glimmering myriads, the whole assemblage of which cannot dissipate, and can scarcely alleviate, the midnight darkness of our world. These stars are visible to us, not because the sun shines upon them, but because they shine of themselves; because they are so many luminous bodies scattered over the tracts of immensity—in a word, because they are so many suns, each throned in the centre of his own dominions, and pouring a flood of light over his own portion of these unlimitable regions.

Before bringing to a close this rapid sketch of modern astronomy, it may be right to advert to some other points of interesting speculation. The first is suggested by the consideration, that if a body be struck in the direction of its centre, it obtains from this course, a progressive motion, but without any movement of revolution being at the same time impressed upon it. It simply goes forward, but does not turn round upon itself. But again, should one stroke not be in the direction of the centre—should the line which joins the point of percussion to the centre, make an angle with that line in which the impulse was communicated, then the body is both made to go forward in space, and also to wheel upon its axis. In this way each of our planets may have had their compound motion communicated to it by one single impulse; and on the other hand, if ever the rotatory motion be communicated by one blow, then the progressive motion must go along with it. In order to have the first motion without the second, there must be a two-fold force applied to the body, *in opposite directions.* It must be set *a-going in* the same way as a spinning-top, so as to revolve about an axis, and to keep unchanged its situation in space. The planets have both motions, and therefore may have received them by one and the same impulse. The sun, we are certain, has one of these motions. He has a movement of revolution. If spun round his axis by two opposite forces, one on each side of him, he may have this movement, and retain an inflexible position in space But if this movement was given him by one stroke, he must have a progressive motion, along with a whirling motion; or, in other words, he is moving forwards; he is describing a tract in space; and in so doing, carries all his planets and all their secondaries (their moons) along with him.

Another interesting tract of speculation has been opened to us by more recent observations of astronomy, in the discovery of the *Nebulæ.* And though it is but a dim and indistinct light which this discovery has thrown upon the structure of the universe, yet still it has spread before the eye of the mind, a field of wide and lofty contemplation. Anterior to this discovery the universe might appear to have been composed of an indefinite number of suns, about equi-distant from each other, uniformly scattered over space, and each encompassed by such a planetary attendance as takes place in our own system. But we have now reason to think that, instead of lying uniformly, and in a state of equi-distance from each other, they are arranged in distinct clusters—that in the same manner as the distance of the nearest fixed star marks the separation of the solar systems; so the distance of two contiguous clusters may mark an equally distant separation of the clusters, and constitute each of them an individual member of some higher and more extended arrangement. This carries us upwards through another ascending step in the scale of magnificence and there leaves us in the awful uncertainty whether even here the wonderful progression is ended.

The universe at large would suffer as little in its splendour and variety, by the destruction of our planet, as the verdure and sublime magnificence of a forest would suffer by the fall of a single leaf. The leaf quivers on the branch which supports it. A breath of wind tears it from its stem, and it lights on the stream of water which passes underneath. In a moment of time the life which we know, by the microscope, it teems with, is extinguished; and an occurrence so insignificant in the eye of man, carries in it, to the inhabitants of this little leaf, an event as decisive as the destruction of a world. Now, on the grand scale of the universe, we, the occupiers of this ball, may feel among the suns and systems unfolded by astronomy, the same littleness and insecurity. We differ from the leaf only in this circumstance, that it would require the operation of great elements to destroy us. But these elements exist. The fire which rages within, may lift its devouring energy to the surface, and change our planet into one wide and wasting volcano. The sudden formation of elastic matter in the bowels of the earth—and it lies within the agency of known substance to accomplish this—may explode it into fragments. The exhalation of noxious air from below, may impart a virulence to the air that surrounds us, and the whole of animated nature may wither and die. A blazing comet may cross us in its orbit, and realize all the terrors which superstition has conceived of it. We cannot anticipate with precision the effect of an event which every astronomer must know to lie within the limits of probability. It may hurry our globe towards the sun—or drag it to the outer regions of our planetary system—or give it a new axis of revolution;—and this would change the place of the ocean and bring another mighty flood upon our islands and continents. These are changes which may happen in an instant of time, and against which nothing known in the present system of things provides us with any security. They might not annihilate the earth, but they would unpeople it; and if the Almighty let loose the devouring elements which are in his hands, they would spread solitude, silence, and death, over the dominion of the world.

Now it is this littleness and insecurity, which makes the protection of the Almighty so dear to us, and brings with such power to every pious bosom the holy lessons of humility and gratitude. The God who sitteth above, and presides in high authority over all worlds, is mindful of man; and, though at this moment his energy is felt in the remotest provinces of creation, we may feel the same security in his providence, as if we were the objects of his undivided care. It is not for us to comprehend this mysterious agency. But such is the fact, that the same Being, whose eye is over the whole universe, gives vegetation to every blade of grass, and motion to every particle of blood which circulates through the veins of the minutest animal; that, though his mind takes into its comprehensive grasp, immensity, and all its wonders, I am as much known to him as if I were the single object of his attention; that he marks all my thoughts; and that, with an exercise of power I can neither describe nor comprehend, the same God who sits in the highest heavens, and reigns over the glories of the firmament, is at my right hand, to give me every breath which I draw, and every comfort I enjoy,

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PHENOMENA OF

A TOTAL ECLIPSE OF THE SUN.

FEW persons have an opportunity of seeing a total eclipse of the sun, and consequently are, for the most part, unacquainted with the phenomena connected with it.

Capt. Stannyan, while at Bern, in Switzerland, describing that which took place on April 22, 1715, informs us, that the sun was *totally dark* for four minutes and a half; that during great part of the eclipse he saw one of the fixed stars and a planet, which appeared exceedingly bright; and that the sun's getting out of the eclipse was preceded by a dark blood-red streak of light, which continued for six or seven seconds; that, after this, a part of the sun's disk suddenly appeared like the incipient horns of the moon, and was as bright as Venus was ever seen in a fine starry night; and that it gave a shadow to things as strong as moon-light is accustomed to do.

J. C. Facis, at Geneva, says, that during the time of the darkness at least sixteen stars were counted by persons residing in that country; and that many who lived on the mountains saw the starry sky in such places as were not overcast, just as we do during the night when the moon is at the full.

Dr. J. J. Scheuchzer, at Zurich, says, that the birds went to roost; that the bats came out of their holes; that the fishes swam about; that a manifest sense of cold was experienced; and that the dew fell upon the grass.

Dr. Halley, describing the same eclipse as seen in London, corroborates these statements. He informs us, that the degree of darkness was very great in London; that Jupiter, Mercury, and Venus were seen by the gentlemen of the Royal Society from the top of their house; and that others saw some of the fixed stars, as *Capella* and *Aldebaran*: that the chill and damp attendant on the eclipse was felt by all the spectators; that they could not behold the scene before them without some sense of horror; and that all sorts of animals, birds, beast, and fishes, seemed to participate in the general feeling caused by this apparent extinction of the sun.

THE LOCUST.

TO look at a locust in a cabinet of insects, you would not at first sight deem it capable of being the source of so much evil to mankind as stands on record against it. "This is but a small creature;" you would say, "and the mischief which it causes cannot be far beyond the proportion of its bulk." Yet although this animal be not very tremendous for its size, nor very terrific in its appearance, it is the very same whose ravages have been the theme of naturalists and historians of all ages; and upon a close examination you will find it to be peculiarly fitted and furnished for the execution of its office. It is armed with two pair of very strong jaws, the upper terminating in short and the lower in long teeth, by which it can both lacerate and grind its food—its stomach is of extraordinary capacity and powers—its hind legs enable it to leap to a considerable distance, and its ample vans are calculated to catch the wind as sails, and to carry it sometimes over the sea; and although a single individual can effect but little evil, yet when the entire surface of a country is covered by them, and every one makes bare the spot on which it stands, the mischief may be as infinite as their numbers. So well do the Arabians know their power, that they make a locust say to Mahomet—"We are the army of the great God; we produce ninety-nine eggs; if the hundred were completed, we should consume the whole earth and all that is in it."

The earliest plague produced by locusts, which has been recorded, is that with which the Egyptian tyrant and his people were visited for their oppression of the Israelites. Only conceive to yourself a country so covered by them that no one can see the face of the ground—a whole land darkened, and all its produce, whether herb or tree, so devoured that not the least vestige of green is left in either.—But it is unnecessary to enlarge upon a history the circumstances of which are so fully known.

To this species of devastation Africa in general seems always to have been peculiarly subject. This may be gathered from the law in Cyrenaica mentioned by Pliny, by which the inhabitants were enjoined to destroy the locusts in three different states three times in the year—first their eggs, then their young, and lastly the perfect insect. And not without reason was such a law enacted: for Orosius tells us, that in the year of the world 3,800, Africa was infested by such infinite myriads of these animals, that having devoured every green thing, after flying off to sea, they were drowned, and being cast upon the shore, they emitted a stench greater than could have been produced by the carcases of 100,000 men. St. Augustine also mentions a plague to have arisen in that country from the same cause, which destroyed no less than 800,000 persons in the kingdom of Masanissa alone, and many more in the territories bordering upon the sea. Mr. Barrow, also, a recent traveller in Africa, tells us, that when an immense swarm was driven into the sea by a N. W. wind, they formed upon the shore for fifty miles a bank three or four feet high, and when the wind was S. E. the stench was so powerful as to be smelled at the distance of 150 miles.

From Africa this plague is occasionally imported into Italy and Spain; and a historian quoted in Mouffet relates, that in the year 591, an infinite army of locusts of a size unusually large, grievously ravaged part of Italy: and being at length cast into the sea, from their stench arose a pestilence which carried off near a million of men and beasts. In the Venetian territory, also, in 1478, more than 30,000 persons are said to have perished in a famine occasioned by the same terrific visitation.

Even Britain, so remarkably distinguished by its exemption from most of those scourges to which other nations are exposed, was once alarmed by the appearance of locusts. In 1748, they were observed in considerable numbers, but providentially they soon perished without propagating. They were evidently stragglers from the vast swarms which in the preceding year did such infinite damage in Wallachia, Transylvania, Hungary, and Poland. One of these swarms, which entered Transylvania in August, was several hundred fathoms in width, (at Vienna the breadth of one of them was three miles,) and extended to so great a length as to be four hours in passing over the Red Tower; and such was its density, that it totally intercepted the solar light, so that when they flew low one person could not see another at the distance of twenty paces. A similar account has been given me by a friend of mine, long resident in India, where he informs me, the column they composed extended five hundred miles; and so compact was it when on the wing, that, like an eclipse, it completely hid the sun, so that no shadow was cast by any object; and some lofty tombs distant from his residence not more than two hundred yards were rendered quite invisible.

Dr. Clarke, to give some idea of the infinite numbers of these animals, compares them to a flight of snow when the flakes are carried obliquely by the wind. They covered his carriage and horses, and the Tartars assert that people are sometimes suffocated by them. The whole face of nature, he says, might have been described as covered by a living veil. They consisted of two species, the Gryllus tartaricus, and Gryllus migratorious: the first is almost twice the size of the second, and, because it precedes it, is called by the Tartars, the herald, or messenger.

From 1778 to 1780 the empire of Morocco was terribly devastated by them; and a most dreadful famine ensued. The poor were seen to wander over the country, deriving a miserable subsistence from the roots of plants; and women and children followed the camels, from whose dung they picked the indigested grains of barley, which they devoured with avidity. On this sad occasion, such was the extremity to which they were reduced, that fathers sold their children, and husbands their wives.

The Arabs of the desert, "whose hands are against every man," and who rejoice in the evil that befals other nations, when they behold the clouds of locusts proceeding from the north, are filled with gladness, anticipating a general mortality.—For when a country is thus laid waste they emerge from their arid deserts and pitch their tents in the desolated plains.

But no account of the appearance and ravages of these terrific insects, for correctness and sublimity, comes near that of the prophet Joel,—with whose animated description I shall conclude. *A day of darkness and of gloominess, a day of clouds and of thick darkness, as the morning spread upon the mountains; a great people and a strong; there hath not been ever the like, neither shall be any more after it, even to the years of many generations. A fire devoureth before them; and behind them a flame burneth: the land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them. Like the noise of chariots on the tops of mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle array. Before their faces the people shall be much pained; all faces shall gather blackness. They shall run like mighty men; they shall climb the wall like men of war; and they shall march* *every one on his ways, and they shall not break their ranks; neither shall one thurst another; they shall walk every one in his path: and when they fall upon the sword they shall not be wounded. The earth shall quake before them; the heavens shall tremble: the sun and the moon shall be dark, and the stars shall withdraw their shining.*

The usual way in which they are destroyed is also noticed by the prophet. *I will remove far off from you the northern army, and will drive him into a land barren and desolate, with his face towards the east sea, and his hinder part toward the utmost sea: and his stink shall come up, and his ill savour shall come up, because he hath done great things.*

THE FECUNDITY OF FISHES.

THOSE animals which are intended by our beneficent Creator to constitute our food are in general remarkably prolific, and among these we may consider fishes as by far the most conspicuous.

M. Rousseau, a laborious French anatomist, has taken the pains to reckon the number of ova contained in the ovaries of several species, and he found the following—

In the	Sturgeon	1,467,856	Eggs.
——	Mackarel	129,200	——
——	Perch	69,216	——
——	Carp	167,400	——
——	Pike	166,400	——

Dr. Baster counted 12,444 eggs under the tail of a lobster, besides those which remained in its body unprotruded.—Pennant also, speaking of the vast quantities of lobsters sent to the London markets from the Orkney Isles and the eastern coast of Scotland, states that 60, or 70,000 are annually brought in well-boats from the neighbourhood of Montrose alone.—Leuwenhoek counted 9,384,000 eggs in a cod-fish of a middling size.

The immeasurable increase of the herring may be inferred from Pennant's description of the great shoal which annually appears off the Shetland Isles, in June. During the two preceding months the advanced guard, as it may be termed, of the immense army precedes; and is marked by the flocks of gannets and other birds which prey upon it. But when the main body approaches, its breadth and depth are such as to alter the appearance of the very ocean. It is divided into distinct columns of five or six miles in length, and three or four in breadth.

A similar multiplication of pilchards may be inferred from the enormous quantities which annually visit the coast of Cornwall. The number taken at one shooting out of the nets is amazingly great.—Dr. Borlase states that on the 5th of October, 1767, there were at one time inclosed in St. Ives's Bay, 7000 hogsheads, each hogshead containing 35,000 fish.—So that the number of pilchards inclosed in one day was 245,000,000.

PROGRESS OF A POUND OF COTTON.

THE following history of a pound weight of manufactured Cotton, will shew the importance of the trade to the country in a very conspicuous manner.

The wool came from the East-Indies to London; from London it went to Lancashire, where it was manufactured into yarn; from Manchester it was sent to Paisley, where it was woven; it was next sent to Ayrshire, where it was tamboured; afterwards it was conveyed to Dunbarton, where it was hand-sewed, and again returned to Paisley, whence it was sent to a distant part of the county of Renfrew to be bleached; and was returned to Paisley, whence it was sent to Glasgow, and was finished; and from Glasgow was sent by coach to London.

It is difficult to ascertain precisely the time taken to bring this article to market; but it may be pretty near the truth to reckon it three years from the time it was packed in India till, in cloth, it arrived at the merchant's warehouse in London. During this progress it must have been conveyed 5000 miles by sea, and 920 by land; and contributed to the support of no less than 150 people, whose services were necessary in the carriage and manufacture of this small quantity of cotton, and by which the value has been advanced 2000 per cent.

PROHIBITION OF THE BIBLE.

IN the reign of Henry the Fifth, a law was passed against the perusal of the Scriptures in English. It is enacted, "That whatsoever they were that should read the Scriptures in the mother tongue, they should forfeit land, catel, lif, and godes from theyre heyres, for ever: and so be condemned for heretykes to God, enemies to the crown, and most errant traitors to the lande."—Such was the intolerance and misguided zeal of this otherwise great monarch, goaded, as he undoubtedly was, by the bigotry of the principal ecclesiastics of his time. The new translation of the Scriptures, by Wicliff, was the work against which this hostility seems to have been directed.

ANECDOTE OF TILLOTSON.

A GENTLEMAN calling on Archbishop Tillotson, observed in his library one shelf of books of various forms and sizes, all richly bound, finely gilt and lettered. He enquired what favourite authors those were that had been so remarkably distinguished by his Grace? "These," said the archbishop, "are my own personal friends, and what is more, I have made them such (for they were avowedly my enemies) by the use I have made of those hints which their malice had suggested to me. From these I have received more profit than from the advice of my best and most cordial friends; and therefore you see I have rewarded them accordingly."

After the death of Tillotson, a bundle of libels was found among his papers, on which he had written, "These are libels: I pray God forgive the authors as I do."

DIVERSITY OF COLOURS.

IN an interesting work of the celebrated Goethe, it is stated, that about fifteen thousand varieties of colours are employed by the workers of mosaic in Rome, and that there are fifty shades of each of these varieties, from the deepest to the palest; thus affording seven hundred and fifty thousand tints, which the artist can distinguish with the greatest facility. It might be imagined that, with the command of seven hundred and fifty thousand tints of colour, the most varied and beautiful painting might be perfectly imitated: yet this is not the case; for the mosaic workers find a want of tints, even amid this astonishing variety.