have been as long as the Wernerian system, and the book of nature, and I may add the term GENERATIONS, employed by Moses himself, seem to indicate.

Nor let it be supposed for a moment, that the term *day* in the Hebrew tongue seems to demand a limitation to the period of four-and-twenty hours, as it ordinarily imports; for there is no term in any language that is used with a wider latitude of construction than the Hebrew יום (*jom*), or its Arabic form, which is the word for day in the original. We are constantly, indeed, employing this very word, as Englishmen, with no small degree of freedom, in our own age; for you will all allow me to drop the phrase "in our own AGE," and to adopt "in our own DAY" in its stead; thus making AGE and DAY terms of similar import. But in Hebrew the same term is employed, if possible, in a still wider range of interpretation: for it not only denotes, as with ourselves, half a diurnal revolution of the earth, or a whole diurnal revolution, but in many instances an entire year, or revolution of the earth round the sun; and this not only in the prophetic writings, which are often appealed to in support of this remark, but in plain historical narrative as well. Thus in Exod. xiii. 10, the verse, "thou shalt keep this ordinance in its season *from year to year*," if literally rendered, would be "*through days of days*," or, "through *days upon days*,"—מימים ימימה. And in like manner, Judges, xvii. 16, "I will give thee ten *shekels* of silver *by the year*," if strictly interpreted, would be "*per dies—for the days*,"—that is, "for the ANNUAL CIRCLE of days,"—לימים.

Sometimes, again, the Hebrew יום, or day, comprises the whole term of life, as in 1 Chron. xxix. 15—

> Our DAYS (ימינו) on earth are a shadow,
> And there is none abiding.

So again, Job, xiv. 6—

> Turn from him that he may rest,
> Till he shall accomplish, as an hireling, his DAY—יומו.

But the clearest and most pertinent proof of the latitude with which the term יום, or DAY, is employed in the Hebrew Scriptures, is in the very narrative of the creation before us: for after having stated in the first chapter of Genesis that the work of creation occupied a period of SIX DAYS, the same inspired writer, in recapitulating his statement, chap. ii. 4, proceeds to tell us, "these are"—or rather, "*such were* the GENERATIONS of the heavens and of the earth when they were created; IN THE DAY (ביום) that the Lord God made the earth and the heavens." In which passage Moses distinctly tells us that, in the preceding chapter, he has used the term יום, DAY, in the sense of generation, succession, or epoch; while we find him here extending the same term DAY to the whole hexaemeron, the entire term of time, whatever it may be, that these six days or generations filled up. So that the sense given to the word by Moses, instead of limiting us to the idea of twenty-four hours' duration, naturally leads us to ascribe, not only a different, but a much enlarged extent of time to the divisions he has marked by the word יום, or DAY: or at least to those terms which occurred before the government of the sun and the moon was established, and the heavenly orrery commenced its harmonious action.

Whether, indeed, the days from this last period, constituting the fifth and sixth, were of a different length from any of the preceding, which may also have differed from each other, and were strictly diurnal revolutions of twenty-four hours, it is impossible exactly to determine. But it is a question which by no means affects the actual face of nature or the geological system before us: for as the third or horizontal series of rocks in which petrifactions of KNOWN animal and vegetable substances begin to make their appearance must have continued to augment for ages after the completion of the hexaemeron, or six epochs of creation, whatever be the duration assigned to them; and as the two loftiest, the fourth and fifth sets of rocks,

or the alluvial and volcanic, are still forming, and have been, ever since the great work of creation was completed, the precise duration of the last two days of creative labour can have no influence upon this question. But to a plain yet attentive reader of the Mosaic account even these two days must, I think, appear to have been of a far more protracted length than that of twenty-four hours each, and especially the sixth day; for it is difficult to conceive how the first parent of mankind could have got through the vast extent of work assigned to him within the short term of twelve or fourteen hours of day-light, without a miracle, which is by no means intimated to us, and as difficult to suppose that he was employed through the night. On this last day were created, as we learn from Gen. i. 24—28, all the land-animals after their kind, cattle, and wild beasts, and reptiles; then Adam himself, but alone; who was next, as we learn from ch. ii. 15—22, taken and put into the garden of Eden, *to dress it and to keep it;* where he had explained to him the trees he might eat of, and the tree he might not; after which were brought to him, that he might make himself acquainted with their respective natures, every beast of the field and every fowl of the air; to all of whom he gave names as soon as their respective characters became known to him. Subsequently to which (for at this time, v. 20, there was not found a help-meet for him), he was plunged into a deep sleep, when the woman was formed out of a part of himself, which completed the creative labour of this last day alone.

That the same Almighty Power who created light by a word, saying יהי אור ויהי אור "be light! and light was,"* could have ruled the whole of this, or even formed the universe, by a word, as well, is not to be doubted; but as both the book of revelation and the book of nature concur in telling us that such was not the fact, and that the work of creation went on progressively, and under the influence of a code of natural laws, we are called upon to examine into the march of this marvellous progress by the laws of nature referred to, and to understand it by their operations. Nor is it more derogatory to Him with whom a thousand years are as one day, and one day as a thousand years, to suppose that He allotted six hundred or six thousand years to the completion of his design, than that He took six solar days for the purpose; and surely there is something far more magnificent in conceiving the world to have gradually attained form, order, and vitality, by the mere operation of powers communicated to it in a state of chaos, through a single command, which instantly took effect and commenced, and persevered and perfected the design proposed, than in conceiving the Almighty engaged in personal and continuous exertions, though for a more limited period of time.

Thus, in progressive order, uprose the stupendous system of the world: the bright host of morning stars shouted together on its birth-day; and the eternal Creator looked down with complacency on the finished fabric, and "saw that it was good."

LECTURE VIII.

ON ORGANIZED BODIES, AND THE STRUCTURE OF PLANTS COMPARED WITH THAT OF ANIMALS.

FROM the unorganized world, which has formed the main subject of our last two lectures, let us now rise a step higher in the scale of creation; and ascend from insentient matter to life, under the various modifications it assumes, and the means by which it is upheld and transmitted.

If I dig up a stone, and remove it from one place to another, the stone will suffer no alteration by the change of place; but if I dig up a plant and remove it, the plant will instantly sicken, and perhaps die. What is the cause of this

* Gen. i. 3.

difference? Both have proceeded from a minute molecule, a nucleus or a germ; both have a tendency to preserve their derivative or family configuration, and both have been augmented and perfected from one common soil. If I break the stone to pieces, every individual fragment will be found possessed of the characteristic powers of the aggregate mass; it is only altered in its shape and magnitude: but if I tear off a branch from the plant, the branch will instantly wither, and lose the specific properties of the parent stock.

No external examination, or reasoning *à priori* will explain this difference of effect. It is only by a minute attention to the relative histories, interior structures, and modes of growth of the two substances, that we are enabled to offer any thing like a satisfactory answer; and by such examination we find that the stone has been produced fortuitously, has grown by external accretion, and can only be destroyed by mechanical or chemical force; while the plant has been produced by generation, has grown by nutrition, and been destroyed by death: that it has been actuated by an internal power, and possessed of parts mutually dependent and contributory to each other's functions.

In what this internal power consists we know not. Differently modified, we meet with it in both plants and animals; and wherever we find it we denominate it the *principle of life*, and distinguish the individual substance it actuates by the name of an *organized being*. And hence, all the various bodies in nature arrange themselves under the two divisions of organized and unorganized: the former possessing an origin by generation, growth by nutrition, and a termination by death; and the latter a fortuitous origin, external growth, and a termination by chemical or mechanical force.

This distinction is clear, and it forms a boundary that does not seem to be broken in upon by a single exception. In what, indeed, that wonderful power of crystallization consists, or by what means it operates, which gives a definite and geometrical figure to the nucleus or primary molecule of every distinct species of crystal; and which, with an accuracy that laughs at all human precision, continues to impress the same figure upon the growing crystal through every stage of its enlargement, thus naturally separating one species from another, and enabling us to discriminate each by its geometrical shape alone—we know not: but even here, where we meet with an approach towards that formative effort, that internal action and consent of parts which peculiarly characterize the living substance, there is not the smallest trace of an organized arrangement; while the origin is clearly fortuitous, and the growth altogether external, from the mere apposition of surrounding matter.

So, on the other hand, in corals, sponges, and fuci, which form the lowest natural orders among animals and vegetables, and the first of which seems to constitute the link that connects the animal and vegetable with the mineral world,—for it has in different periods been ascribed to each,—simple as is their structure, and obtuse as is the living principle that actuates them, we have still sufficient marks of an organized make; of an origin by generation, the generation of buds or bulbs, of growth by nutrition, and of termination by death.

But the animal world differs from the vegetable as widely as both these differ from the mineral. How are we to distinguish the organization of animals from that of plants?—In what does their difference consist? and here I am obliged to confess, that the boundary is by no means so clearly marked out; and that we are for the most part compelled to characterize the difference rather by description than by definition. Nothing, indeed, is easier than to distinguish animals and vegetables in their more perfect states: we can make no mistake between a horse and a horse-chestnut tree, a butterfly and a blade of grass. We behold the plant confined to a particular spot, deriving the whole of its nutriment from such spot, and affording no mark either of consciousness or sensation; we behold the animal, on the contrary, capable of moving at pleasure from one place to another, and exhibiting not only marks of consciousness and sensation, but often of a very high degree of intelligence as well. Yet, if we hence lay down consciousness or sensation, and locomotion, as the two characteristic features of animal life, we

shall soon find our definition untenable; for while the Linnæan class of worms affords instances, in perhaps every one of its orders, of animals destitute of locomotion, and evincing no mark of consciousness or sensation, there are various species of plants that are strictly locomotive, and that discover a much nearer approach to a sensitive faculty.

However striking, therefore, the distinctions between animal and vegetable life, in their more perfect and elaborate forms, as we approach the contiguous extremities of the two kingdoms we find these distinctions fading away so gradually,

> Shade, unperceived, so softening into shade,

and the mutual advances so close and intimate, that it becomes a task of no common difficulty to draw a line of distinction between them, or to determine to which of them an individual may belong. And it is probable, that that extraordinary order of beings called zoophytes, or animated plants, as the term imports, and which by Woodward and Beaumont were arranged as minerals,* and by Ray and Lister as vegetables, have at last obtained an introduction into the animal kingdom,† less on account of any other property they possess, than of their affording, on being burnt, an ammoniacal smell like that which issues from burnt bones, or any other animal organs, and which is seldom or never observed from burnt vegetable substances of a decided and unquestionable character. Ammonia, however, upon destructive distillation, is met with in small quantities in *particular parts* of most if not of all vegetables, though never perhaps in the whole plant. Thus it occurs slightly in the wood or vegetable fibre; in extract, gum-mucilage, camphor, resin, and balsam; gum-resin, gluten, and caoutchouc: besides those substances that are common to both animals and vegetables, as sugar, fixed oil, albumen, fibrine, and gelatine. There are some plants, however, that even in their open exposure to a burning heat give forth an ammoniacal smell closely approaching to that of animal substance. The clavarias or club-tops, and many other funguses, do this. But a distinction in the degree of odour may even here be observed, if accurately attended to. Yet the clavarias were once regarded as zoophytes, and are arranged by Millar in the same division as the corals and corallines.‡

M. de Mirbel, in his very excellent treatise "On the Anatomy and Physiology of Plants," has endeavoured to lay down a distinction between the animal and the vegetable world in the following terms, and it is a distinction which seems to be approved by Sir Edward Smith; "Plants alone have a power of drawing nourishment from inorganic matter, mere earths, salts, or airs; substances incapable of nourishing animals, which only feed on what is or has been organized matter, either of a vegetable or animal nature. So that it should seem to be the office of vegetable life alone to transform dead matter into organized living bodies."§ Whence another learned French physiologist, M. Richerand, has observed that the aliments by which animals are nourished are selected from vegetable or animal substances alone; the elements of the mineral kingdom being too heterogeneous to the nature of animals to be converted into their own substance without being first elaborated by vegetable life; whence plants, says M. Richerand, may be considered as the laboratory in which nature prepares aliment for animals.‖

* Phil. Trans. xiii. 277.

† Parkinson's Organic Remains, i. 23, ii. 157, 158.

‡ Several species of this genus of fungi have very singular properties: thus the c. *hæmatodes* has so near a resemblance to tanned leather, though somewhat thinner and softer, as to be named *oak-leather club-top*, from its being chiefly found in the clefts and hollows of oak-trees. In Ireland, it is employed as leather to dress wounds with; and, in Virginia, to spread plasters upon.

There are some cryptogamic plants, and especially among the mosses, that can be hardly made to burn by any means. Such is the fontinella *antipyretica*, so called on this very account; and which is hence in common use among the Scandinavians, as a lining for their chimney sides, and the inside of their chimneys, by way of preservation. So that here we have an approach to mineral instead of to animal substances, and especially to the asbestos and other species of talcose earths. There is one species of byssus, another curious genus of mosses, that takes the specific name of asbestos from this very property. It is found in the Swedish copper mines of Westmann-land in large quantities, and when exposed to a red heat, instead of being consumed, is vitrified.

§ Traité d'Anatomie et de Physiologie Végétale, i. 19.

‖ Elémens de Physiologie, &c. cap. de la Digestion.

I concur with these elegant writers in admitting the beautiful and harmonious relation so obviously established between minerals, plants, and animals; but it is at the same time impossible to allow of the distinction between vegetable and animal life here laid down; because, first, vegetables are by no means nourished exclusively, as, indeed, M. Mirbel himself frankly allows, from terrene elements; and, secondly, because animals are as little nourished exclusively from vegetable materials. Among insects, worms, and even fishes, there are many tribes that derive by far the greater portion of their increase from the mineral kingdom alone; while even in man himself, air, water, common salt, and lime, which last is almost always an ingredient of common salt, are substances indispensable to his growth, and are derived immediately from the mineral kingdom.

In laying down, therefore, a distinctive character for animals and plants, we are compelled to derive it from the more perfect of each kind; and to leave the extreme cases to be determined by the chemical components eliminated on their decomposition. And under this broadview of the subject I now proceed to observe, that while they agree in an origin by generation, a growth by nutrition, and a termination by death; in an organized structure, and an internal living principle; they differ in the powers with which the living principle is endowed, and the effects it is capable of exerting. In the plant it is limited, so far as we are capable of tracing it, to the properties of irritability, contractility, and simple instincts; in the animal it superadds to these properties those of muscularity, sensation, and voluntary motion.

There have been, indeed, and there still are, physiologists who,—not adverting to the extraordinary effects which the power of irritability is capable of producing when roused by different stimulants, and under the influence of an internal and all-pervading principle of life, operating by instinctive laws and instinctive actions, or those, as we shall show hereafter, which are specially directed to the growth, preservation, or reproduction of a living frame, or any particular part of it,—have conceived plants as well as animals to be possessed of sensation and muscular fibres; and as sensation is the result of a particular organ, and the organ producing it is connected with various others, have at the same time liberally endowed them with a brain, a heart, and a stomach; and have very obligingly permitted them to possess ideas, and the means of communicating ideas; to fall in love and to marry, and thus far to exercise the distinctive faculty of volition. The whole of which, however, is mere fancy, grounded altogether upon an erroneous and contracted view of the effects of the principle of irritability when powerfully excited by the influence of light, heat, air, moisture, and other causes.

In reality, such kinds of loves and intermarriages are not peculiar to plants, but are common to all nature: they exist between atom and atom, and the philosopher calls them attractions; they exist between congeries and congeries, and the chemist calls them affinities; they exist between the iron and the loadstone, and every one denominates them magnetism. Nor let it be said that in these cases of mutual union we have nothing more than a mere aggregation of body; for we have often a third substance produced, and actually generated, as the result of such union, far more discrepant from the parent substances both in quality and feature than are ever to be met with in vegetable or animal life. Thus, if an acid be married to an alkali, the progeny brought forth will be a neutral salt, possessing not the remotest resemblance to the virtues of either of its parents. In like manner, if alkohol be married to any of the more powerful acids, and the banns be solemnized over an altar of fire, but not otherwise, the offspring engendered will be a substance called ether, equally unlike both its parents in its disposition. But the form or features are as frequently changed as the temper. Thus, if we unite olive oil, which is a liquid, with some of the oxides of lead, which are powders, the result is neither a liquid nor a powder, nor a medium of the two, which would be a paste, but the hard adhesive plaster usually called diachylon. So, again, if muriatic acid, which is a liquid, sport in dalliance with the

volatile nymph ammonia, which is an invisible gas, the fruit of their embraces will be still more extraordinary in point of form, for the gas and the liquid will engender that solid substance commonly known by the name of sal ammoniac, or, in the new nomenclature, muriate of ammonia. In like manner, our common smelling salts, or carbonate of ammonia, though a hard, concrete crystallization, are the mere result of the union of two invisible gases, ammonia and carbonic acid gas, or fixed air; and which, having duly paid their court to each other, give birth to this solid substance.

But in all this it may be said that we have no instance of a multiplication of species; nor in reality of any thing more than the production of a third substance, issuing, like the fabled phœnix of antiquity, out of the ashes or decomposition of the parent stock; yet in many cases we have instances of multiplication also—and instances far more extraordinary and far more prolific than are ever to be found in the multiplication of either animals or vegetables. Such especially are those wonderful increases that occur in the case of ferments and of contagions. A few particles of yest lying dormant in a dessert-spoon are introduced into a barrel of beer, or of any other fermentable fluid, and in a few hours propagate their kind through the largest vessel that was ever manufactured; so that at length every particle of the fluid is converted into a substance of their own nature. A few pestilential miasms are thrown forth from a stagnant marsh or a foul prison, and give birth instantaneously to myriads and myriads of the same species of particles, till the atmosphere becomes impregnated with them through a range of many miles in diameter. Two or three particles of the matter of plague are packed up in a bag of cotton at Aleppo, and are many months afterward set at liberty in Great Britain. Aided by the stimulus of the air, they instantly set to work, and procreate so rapidly, that the whole country in less than a week is laid prostrate by the enormity of their increase.

Now the terms loves and marriages will just as well apply to all these as to the vegetable creation. The cause of the respective unions, and of the changes that take place in consequence of such unions, are in both cases nothing more than elective attractions: in the mineral and gaseous kingdoms produced by what chemists have denominated the principle of *affinity*, and in the vegetable by what physiologists have called the principle of *irritability*; a principle far nicer and nobler and more delicate than that of affinity, and under the influence of an internal, an all-pervading, and identifying vital power, capable, as differently excited by different stimulants, of producing far nicer and nobler, more delicate and more complicated effects; but which in itself is not more different from the principle of *affinity* than it is from that of *sensation*.

No experiment or observation has hitherto proved vegetables to be possessed of any higher powers than those of irritability, contractility, and those instinctive energies which we shall hereafter show are dependent upon the principle of life.

It is almost superfluous to observe, in this place, that there are also powers and faculties of a much higher character than any I have yet noticed, appertaining to the nobler ranks of animals; for at present I am only pointing out the leading characters by which animals in general may be distinguished from vegetables in general, and shall have sufficient opportunities, as we proceed, of adverting to these additional faculties, and of investigating their respective excellencies.

Our immediate concern, then, is with VEGETABLE LIFE; its general laws, structure, and phenomena. And upon this subject I shall touch as briefly as possible, intending it as a mere vestibule or introduction to the more important study of animal philosophy.

Plants, then, like animals, as I have already observed, are produced by generation, and through the medium of ova, or eggs. The exceptions to this common rule are few, and they occur equally in both kingdoms. The egg of the plant is its seed; a doctrine not of modern origin, but taught and understood quite as clearly, and with as close a reference to the rise of animal life, by the ancients, as in the present day.* The seed is sometimes naked, but more generally covered with a pericarp, whence plants become naturally divided into the two grand arrangements of gymnospermous and angiospermous. The pericarp is of various forms and structures; and of these the more common are the legume, silique, or silicle, being merely varieties of what, among ourselves, is denominated in popular language cod or pod; the loment which is a kind of pod not so frequent as either of the former, but of which we have an instance in the mimosas and the cassia *fistula*; the pome or core-apple, of which we have instances in the common apple and the pear; the drupe, or stone-apple, instances of which occur to us in the plum, cherry, and almond; the glume or chaff; the berry; the acinus or conglomerate berry, as in the rasp; the nut; and the capsule.†

Stripping off this outer covering, we find the seed to consist internally of a *corculum*, or heartlet, and externally of a fleshy or parenchymatous substance, surrounded with a double integument, sometimes single, sometimes bifid, and sometimes more than bifid; and hence denominated monocotyledonous, dicotyledonous, polycotyledonous. In popular language these are called seed-lobes, or seed-leaves: and in the phaseolous *vulgaris*, or common kidney-bean, we have as striking an instance as in any plant, and which every one must have noticed, just peeping in two distinct segments above the ground, as soon as the seed has begun to germinate. It was very generally supposed formerly, and is still supposed by some botanists, that the seeds of various orders of plants, as the mosses, fungi, and algæ, are acotyledonous, or totally destitute of a cotyledon of any kind. But as many, perhaps most, plants of this kind have of late been found to possess some such parenchyma, we have great reason for believing that this organ is universal, and that there is no such thing as an acotyledonous seed in the whole vegetable kingdom. In reality, the cotyledon appears absolutely necessary for the germination and future growth of the seed, and may hence be denominated its lungs or placentule. Like the perfect plant, it possesses lymphatics and air-vessels. Through the former of these it absorbs the moisture of the soil into which it is plunged, decomposes a part of it into its elementary principles, and conducts those principles, together with the undecomposed water, to the corcle or heartlet, which becomes stimulated to the process of germination by the oxygen thus set at liberty.

Mrs. Ibbetson has attempted to prove that the cotyledon is of no use whatever for the purpose of nourishment; which, according to her observations, is only conveyed to the corcle by what she calls a system of nourishing vessels, altogether distinct from the cotyledon. It is not very clear, however, what is here meant by nourishing vessels; nor can we for a moment admit that so large an organ as the cotyledon, and apparently so important, can be designed for no other office than merely, as this lady conjectures, to screen the primordial leaves from the light and air on their first formation."‡

According to Mr. Mirbel's experiments, as detailed in the Memoirs of the National Institute, the soil and the albumen in the cotyledon are both concerned in the developement of the germ; and both continue to contribute conjointly till the albumen is entirely absorbed: at which time the plant has strength enough to derive from the soil or the atmosphere the nourishment it requires from this period. In this respect the albumen of the cotyledon corresponds with the vitellus of the hen's egg.

In marine plants that are destitute of a radicle, as the water caltrop (trapa

* Οὕτω δ' ὠοτοκεῖ μακρὰ δένδρεα πρῶτον ἐλαίας.
Empedocles.

So plants, like animals, uprise to air,
And in green eggs young olives olives bear

And upon this beautiful verse, which he has preserved as a fragment, Aristotle remarks, τό τε γὰρ ὠὸν κύημά ἐστι, καὶ ἔκ τινος αὐτοῦ γίγνεται τὸ ζῶον. "For the egg is the conception, and after the same manner the animal is created."—*De Generat. Animal.* i. 23.

† Compare Knight's General Theory of Vegetable Physiology, Horticultural Transactions, vol. i. p. 217, with Nicholson's Journal, vol. xxxii. p. 350.

‡ Nicholson's Journal, vol. xxvii. 9.

natans), the germ must necessarily be supported in the first instance by means of the cotyledon.

It is the corcle which is the true *punctum saliens* of vegetable life, and to this the cotyledon is subservient. The corcle consists of two parts, an ascending and a descending; the former called its plumule, which gives birth to the trunk and branches; the latter named its rostel, which gives birth to the root and radicles. The position of the corcle in the seed is always in the vicinity of the *hilum* or eye, which is a cicatrix or umbilicus remaining after the separation of the *funis* or umbilical cord from the pericarp, to which the seed has hereby been attached. The first radicle or germinating branch of the rostel uniformly elongates, and pushes into the earth, before the plumule evinces any change. Like the cotyledon, the radicles consist chiefly of lymphatics and air-vessels, which serve to separate the water from the soil, in order that the oxygen may be separated from the water.

Hence originates the root, unquestionably the most important part of the plant, and which in some sense may be regarded as the plant itself: for if every other part of the plant be destroyed, and the root remain uninjured, this organ will regerminate and the whole plant be renewed; but if the root perish, the plant becomes lost irrecoverably. Yet there are various phenomena in vegetable life that manifest a smaller difference in the nature of the root and the trunk, than we should at first be induced to suppose; for Willoughby observed, more than a century and a half ago,* that in several species, and especially those of the prunus and salix, cherry and willow tribes, if the stem branches be bent down to the earth, plunged into it, and continued in this situation for a few months, these branches will throw forth radicles; and if, after this, the original root be dug up, and suffered to ascend into the air, so that the whole plant become completely inverted, the original root will throw forth stem-branches and bear the wild fruit peculiar to its tribe. The rhizophora *Mangle*, or mangrove-tree, grows naturally in this manner; for its stem-branches, having reached a certain perpendicular height, bend downwards of their own accord, and throw forth root-branches into the soil, from which new trunks arise, so that it is not uncommon, in some parts of Asia and Africa, to meet with a single tree of this species covering the oozy waters in which it grows with a forest of half a mile in length. The ficus *Indica*, or banyan, grows in the same manner, and often with enormous trunks, equally derived from a primary root. The largest tree of this kind known to Europeans, is on an island in the river Nerbedda in the Guzzerat, distinguished in honour of a Bramin, of high reputation, by the name of Cubbeer Bur. High floods have destroyed many of its incurved stems, yet its principal stems measure two thousand feet in circumference, the number of its larger trunks, each exceeding the bulk of our noblest oaks, amount to three hundred and fifty, while that of its smaller are more than three thousand; so that seven thousand persons may find ample room to repose under its enormous shade, and may at the same time be richly supplied from the vast abundance of fruit which it yields in its season.

The solid parts of the trunk of the plant consist of CORTEX, cuticle, or outer bark; LIBER, CUTIS, or inner bark; ALBURNUM, or soft wood; LIGNUM, or hard wood;† and MEDULLA, or pith. Linnæus gave the name of medulla to the pith of plants, upon a supposition that it had a near resemblance to the medulla spinalis of quadrupeds. A closer investigation, however, has since proved that this resemblance is very faint, and that the pith or medulla of

* Phil. Trans. year 1669, iv. p. 963,—1670, v. p. 1165. 1168. 1199,—1671, vi. p. 2119.

† There is a curious paper of Count Rumford's, mentioned among the labours of the French Imperial Institute for 1812, upon the chemical properties of the different parts entering into the composition of the trunk of trees; for an account of which see also Thomson's Annals of Philos. vol. i. p. 386. By a variety of experiments Count Rumford was led to this singular conclusion, that the specific gravity of the solid matter which constitutes the *timber* of wood is almost the same in all trees. By the same means he determined that the woody part of oak in full vegetation is only four-tenths of the whole. Air constitutes one-fourth of it, and the rest consists in sap. Light woods have still a much less quantity of solid matter: but the season of the year and the age of the tree occasion considerable variations. Ordinary dry wood contains about one-fourth of its weight of water. Even the oldest wood, though in the state of timber for ages, never contains less than one-sixth of its weight of water. All absolutely dry woods give from 42 to 43 per cent. of charcoal: whence he concludes, that the ligneous matter is identic in all woods.