CURIOSITIES OF VEGETATION.

THE vegetation which everywhere adorns the surface of the globe, from the moss that covers the weather-worn stone, to the cedar that crowns the mountain, is replete with matter for reflection and admiration. Not a tree that lifts its branches aloft, not a flower or leaf that expands beneath the sunlight, but has something of habit or of structure—something of form, of fragrance, or of colour—to arrest the attention. It is true that early and constant familiarity has a tendency to render us unobservant of that which surrounds us; but that individual must be idle, and ignorant as idle, whose curiosity cannot be awakened by a description of the wonderful mechanism and adaptations of vegetable life. It is to a brief account of the more remarkable phenomena that the following pages are devoted; not with a view to excite mere unreasoning wonder, but with a desire to create a spirit of inquiry into principles as well as into facts, and to lead the mind to one of the most agreeable pursuits which the wide field of nature presents.

GENERAL CHARACTERISTICS OF PLANTS.

Minerals, plants, and animals, are all formed by the chemical combination of certain elementary substances. In minerals, these elements combine by the force of chemical affinity only; but in plants and animals, they are held in combination by vital action. Vitality enables plants and animals to absorb and assimilate food, consisting of the elements necessary for their increase, and also to reproduce beings of their own kind by means of certain organs;

hence they are said to be *organised*, and the substances of which they are composed are known by the general name of *organic matter*. Minerals not possessing vitality have no organs, and consist only of *inorganic matter*. Plants derive their sustenance from inorganic matter—air, earth, and water; animals cannot do so, but must live on vegetables, or prey upon each other. Vegetation, therefore, must be the precursor of animal life in the economy of nature.

The simplest forms of life are observable in certain plants and animals whose economy is limited to the absorption and assimilation of nutriment, and the power of reproduction; and the difference between these humble plants and animals is so trifling, that in them the animal and vegetable kingdoms seem to pass into each other. Thus, notwithstanding all the light which modern science has thrown on organic life, we are yet unable to distinguish between certain lowly forms of corallines and sponges, and to say which are plants and which are animals. But while to the eye of imperfect knowledge the lowest forms of plants and animals seem to merge into each other, it must be ever borne in mind that, beyond a faint analogy, there is nothing like identity between the respective functions of these two great kingdoms.

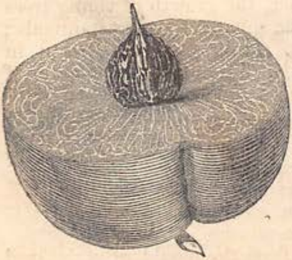
Few plants possess the power of locomotion; and though the aquatic plant called the fresh-water sailor seems to detach itself from the mud in which it originally grows, and rises to the surface of the water to expand its flowers, this must be regarded as the necessary result of a peculiar mechanism, and not of volition. Plants are propagated by division; and it is only among the lowest living forms, as sponges and polyps, that detached parts will become perfect individuals. Plants have no stomach; and though the lobe-like leaves of Venus's fly-trap are said to digest the flies they catch, this fact must be regarded rather as the result of ordinary decay than of true digestion. Plants are without feeling. Though the leaves of the sensitive plant shrink at the slightest touch, yet we cannot, without a misapplication of words, apply the term feeling where no nervous structure has yet been discovered. In like manner, the growth of young trees and shrubs has been compared to the spinal marrow of animals; the upward current of the sap in spring, and its descent in autumn, to the circulation of the blood; and the exhalation of oxygen, and the absorption of carbonic acid gas in the leaves, to respiration; but all these are mere analogies, not identities of function. Indeed all the vital operations of plants are performed in a different manner from those of animals; the instances of locomotion, sensitiveness, and power of digestion in plants being very rare and imperfect, while the power of propagating by division in animals is equally so.

Plants, whether rooted in the soil or on other organic bodies —whether floating in water or suspended in the atmosphere, are dependent upon air, moisture, heat, and light, for their perfect development. Besides these conditions, many require nourishment from the soil; but, strange as it may appear at first sight, soil is not essential to vegetation in general; for many plants, such as aquatics, parasites, and aërials, grow and propagate their kind without once coming in contact with the ground. It is common to divide the vegetable kingdom into two great sections—those plants which flower, as trees, shrubs, and grasses, and those which do not flower, as ferns, sea-weeds, and mushrooms. It is also usual to arrange them according to their manner of growth. Thus, some increase by external layers, as the fir, the wood of which shows many concentric layers, each ring being a year's growth; others grow from within, as the palm, the trunk of which shows no concentric layers; and some increase by mere prolongation of the apex, or growing point, as the ferns, sea-weeds, and lichens. Those which increase by external layers, have the nerves of the leaves reticulated or netted, as in the apple; those which grow by internal additions, have the nerves arranged in parallel order, as in the lily; and those which add to their bulk by simple extension of the growing point, have no distinct venation, as in the lichens.

REPRODUCTION AND DISPERSION OF PLANTS.

The main object of a plant during growth seems to be the reproduction of its kind. Whether the term of its being be limited by a day, by a year, or by centuries, its sole effort—as it proceeds from leaf to stem, from stem to branch, and from branch to flower and fruit—is the multiplication of itself. This is effected variously: by seeds, by spores or embryo plants, by tubers, by runners which put forth shoots as they elongate, by branches which send down roots, by branches bending downwards and taking root, by slips or detached branches, or even by single leaves.

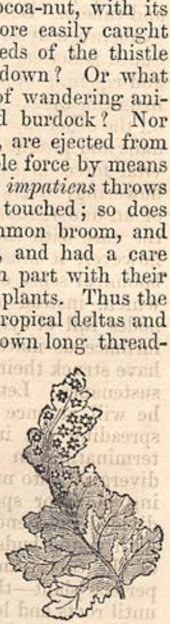
Increase by seed is the most familiar mode of reproduction, being common to all flowering plants. Seeds are merely leaves preserved in peculiar cerements against the return of the season of growth. They are also furnished with a sufficiency of nutriment for the embryo plant, till its roots have struck into the soil, and its leaves be expanded into the atmosphere. For the excitement of growth in seeds, a certain amount of heat and moisture is necessary; but too much heat would parch them, and too much cold or moisture would destroy their vitality. To provide against



Section of a Peach.

such contingencies, nature has conferred on them the most ingenious and perfect coverings. The cocoa has a tough fibrous coir and woody nut impervious alike to drought and rain; the chestnut has a compact leathery envelope; the peach a hard stony drupe; the apple a fleshy pome, enclosing leathery cells; the rose a waterproof hip, packed with down; the pea and bean a pod of parchment; and seeds apparently naked have either a coriaceous membrane, or have their exterior tissue so condensed, that they look as if they had come from the hand of the japanner. In all of them, the protection against cold, drought, moisture, and other destructive agencies is so complete, that seeds which have been buried for centuries have, on being brought to the surface, sprung up into healthy plants: even a crop of wheat has been reared from seeds taken from the hand of an Egyptian mummy more than three thousand years old!

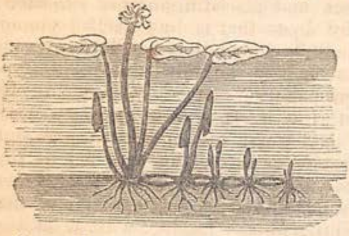
Equally perfect with this protection is the means for their dispersion over the surface of the globe. What could be better adapted for floating from island to island than the cocoa-nut, with its light fibrous coir and woody shell? What more easily caught up by the slightest breath of air than the seeds of the thistle or dandelion, with their little parachutes of down? Or what more aptly fitted for attachment to the coats of wandering animals than the hooked heads of the teasel and burdock? Nor does contrivance end here. Many, when ripe, are ejected from the vessels which contain them with considerable force by means of elastic valves and springs. The *Cardamine impatiens* throws its ripe seed to a considerable distance on being touched; so does the squirting cucumber, the geranium, the common broom, and others, as if they were endowed with vitality, and had a care for their embryo progeny. Some do not even part with their seeds till these have struck root as independent plants. Thus the mangrove, which flourishes amid the mud of tropical deltas and creeks, retains its berries till they have sent down long thread-like radicles into the silt below, as if it felt that the water and slime by which it was surrounded were elements too unstable to be intrusted with its offspring.


Female Fern.

Plants that reproduce themselves by spores or germs belong to the flowerless section of vegetation, as the ferns, sea-weeds, mosses, mushrooms, and the like. In many of these the reproductive spores are so minute that they float in the air unseen; and not a dried mushroom or puff-ball that is struck by the wandering foot, but disperses thousands of its kind around it. The little brown specks on the leaf of the fern, the snuff-like powder of the puff-ball, or the dust arising from the mould of a decayed cheese, are all alike the germs of future plants; and when we consider how minute each individual is, how liable to be borne about by winds, by water, and by the coverings of animals, to which they may adhere, we shall cease to wonder at the fact, that there is not a portion of surface, organic or inorganic, that may not be covered with their growth. The spores of sea-weeds, which are always surrounded by water, are covered by a mucilage that enables them to adhere to whatever solid body they touch; and what is peculiar in this adhesive substance—it is insoluble in water. "Let chemistry," says Macculloch in his Illustrations of the Attributes of God, "name another mucilage, another substance which water cannot dissolve, though apparently already in solution with water, and then ask if this extraordinary secretion was not designed for the special end attained, and whether also it does not afford an example of that Power which has only to will that it may produce what it desires, even by means the most improbable."

Many plants, as the potato, reproduce themselves both by seeds and tubers. Both modes, however, do not take place with equal exuberance at one and the same time. In its native region of South America, where the climate is better adapted for blossom and ripening of seed, the potato flowers luxuriantly, but yields an insignificant crop of small acrid tubers: in our unstable climate, on the other hand, the underground progeny is the more abundant and prolific. There is, it would seem, a certain amount of vital force in every plant, and if that force be expended on flowering, tubers will not be produced, and if on the production of an underground progeny, the seed will not be matured, as is the case with the horse-radish and Jerusalem artichoke. Here, however, it must be remarked, that tubers are not roots in the botanical sense of the word: they are true underground stems, which, instead of terminating in fruit and seed, terminate in nodes full of eyes or leaf-buds, and supplied with a quantity of farinaceous matter for the support of the young buds, till they have struck their roots in the soil sufficient to elaborate their own sustenance. Let any one unearth a potato plant with care, and he will at once perceive the difference between the true roots spreading out into minute fibres, and the underground stems terminating in tubers. The former are tough and fibrous, diverging into minute radicles, each tipped with its little sucking point or spongiole; the latter are soft and succulent, undivided, and ending in a mass of farinaceous matter, studded with young buds. Each of these buds, if detached with a portion of the tuber, and placed in proper soil, will spring up into a perfect plant—the farinaceous fragment supplying it with food until roots and leaves are formed.

The manner in which plants reproduce themselves viviparously, differs according to the constitutional character of the individual. Some, as the elm and poplar, have their roots furnished with buds, which sooner or later sprout forth into offsets and suckers, as they are called, and these annually increase in bulk and height, ultimately becoming, under proper conditions, perfect trees. Others, as the greater number of bulbs and tubers, multiply themselves by sending out runners, each of which produce several young plants; and herbaceous perennials extend themselves in the same way, either by runners under ground, as the couch-grass, or above ground, as the strawberry. Most people must have observed the continual efforts of the latter plant to extend itself in this way; and so it is with many others—the propensity being most powerful where there is the least opportunity of bringing forth seed. It is often highly interesting to watch the progress of these runners. Where the soil is soft and favourable throughout, the young shoots are developed at about equal distances; but where the soil is hard, or covered with stones, the runner pushes its way over these obstructions, refusing to put forth a single bud until the proper conditions for its maintenance be reached. We have often seen a gravel walk thus crossed by a strawberry runner, the runner being as budless as a piece of copper-wire, until it had arrived at the soil on the other side, where it immediately put forth its young progeny in abundance. Instances of this kind are often ascribed to vegetable instinct; and were it not for the essential differences which evidently exist between vegetables and animals, one would be almost tempted to assign to it a higher designation. Some plants produce living seeds in the vessels where the ordinary seed is matured, as may be seen in certain species of the onion family, known as tree and apple onions; and others, like some of the lilies, yield little perfect bulbs in the axils of the stem leaves.


Aquatic Plant extending its creeping stems along the mud.

Another manner in which trees multiply themselves is by their branches bending downwards till they touch the ground with the growing points, which then take root and spring up into independent stems. This frequently happens among trailing shrubs, as the bramble and honeysuckle, and may also be witnessed among our garden roses and gooseberries. A somewhat similar mode of extension is presented by the banyan, which becomes enlarged without the assistance of either seeds or suckers. Roots are produced by the under-side of the lower branches: these hang dangling in the air for months before they reach the ground; this at last they penetrate, and become stems to a new head of branches. An old tree of this kind, as will be shown in another section, presents a most magnificent object, forming concentric corridors over a great extent of surface. Acting upon the principles here pointed out by nature, gardeners propagate many of their favourites by layers—that is, by bending a branch or shoot till a portion of it be buried in the soil, where it throws out roots, and establishes itself as an independent plant. This being done, it is removed from the parent stock and placed in another situation. Plants are also propagated by slips—that is, by detached young shoots being thrust into the soil, where they generally throw out roots, and grow up into healthy individuals. Budding is another artificial mode of propagation: it is, in fact, merely slipping at an earlier stage of growth. It is performed by taking the leaf-bud from one tree or branch, and neatly inserting it under the cuticle of another tree or branch, where, fed by the necessary juices, it extends to a new bough or arm.

Perhaps the most curious mode of natural reproduction is that by the leaf. It is well known that many leaves, as those of the echeveria, malaxis, gloxinia, orange, and others, when fallen to the ground in a young and growing state, put forth roots and become perfect plants. This fact is at present exciting much attention; and since all parts of a plant are but special developments of the leaf, it is argued that there is nothing to prevent the propagation of every tree and shrub by means of this single organ.

What a curious view of vegetable life do the principles of reproduction unfold! namely, that all parts of a plant—whether root, tuber, bulb, stem, branch, leaf, or seed—will, under certain conditions, grow up into a perfect individual, similar to the parent from which it has sprung. All modes do not take place at one and the same time, for nature is never prodigally wasteful of her resources; but where climate or other conditions interrupt production by one source, another is developed more exuberantly than usual to supply its place. If we have not conditions to mature fruit and seed, there will be tubers, or suckers, or runners instead; and just as the chances of failure are great, so are the modes of reproduction proportionally increased. There is nothing corresponding to this in the animal kingdom, unless among the very lowest forms, as the polyps and sponges, which also increase by division. Lop away a branch from a tree, and its place may be supplied by another; break off the limb of a crab or insect, and another limb will shortly take its place; but while the detached branch will spring up into a tree similar to its parent, all vitality has fled from the separated limb of the crustacean. Higher animals than insects and crustaceans have no power to reproduce lost parts; but while devoid of this vegetative-like power, they have a more exalted sentient development; and if denied the power to reproduce a lost limb, they are endowed with faculties which can better protect them.

METAMORPHOSES OF VEGETATION.

In a state of nature, certain orders of vegetation are limited to certain localities, these situations being characterised by some peculiarity of soil and atmospheric influence. If the conditions of soil and climate remain the same, the characters of plants are nearly uniform and stationary; and this may be always said of them in their natural state. But if they be removed from a poor to a rich soil, from a warm to a cold climate, from a dry to a moist habitat, or *vice versa*, then their internal structure will undergo a change; and this change will manifest itself in one or other of their external characters. In some classes, the change is most evident in the roots and tubers; in others, in the stems and leaves; while in many, the flowers and fruit are the parts most affected.

The changes which *roots* and *tubers* can be made to undergo are numerous and highly beneficial to man. The potato, for example, is a native of tropical America; and when found wild, its tubers are small and scarcely edible; while in Europe it has been rendered by cultivation one of the most valuable articles of food. The produce of an acre of wild potatoes could be held in a single measure; while in Britain, the same area will yield from forty to sixty bolls. Cultivation has produced a thousand varieties of this tuber, varying in shape, size, colour, and quality. Beet, parsnip, and turnip, are also made to assume many variations under proper cultivation. The bulb of the latter, for instance, has, since the beginning of the present century, been metamorphosed in forms from globular to fusiform, in colours from white and yellow to purple and green, and in weight from a couple of ounces to twenty pounds. So also with the carrot, which in a wild state is a slender tapering fleshy root of a yellowish-white colour, but which by cultivation increases in size, and assumes a deep red or orange colour. In the one case, the root is not much thicker than a common quill; in the other, it becomes as thick and long as a man's arm.

Stems, though less liable to metamorphosis of this kind, are still capable of being strangely changed from their normal condition. Every one is aware that if a tree which is a native of mountains be placed in a valley, it grows more rapidly, and its timber becomes softer and less durable; and in like manner, if the tree of a valley be removed to a mountain, it becomes of slow growth and small dimensions, but produces timber remarkable for its toughness and durability. By cultivating upon this principle, tall stems are for the most part rendered short, and short ones taller; the dahlia, for example, having been reduced to one-half of its natural height by garden culture.

Leaves are also subject to innumerable metamorphoses, arising either from culture, change of season, disease, or injury by insects. Let any one examine the cabbage in its wild state, as it trails among the shingle of the sea-shore, with its slender stem and small glaucous leaves, and then turn to the giant of the garden, with its stout fleshy stalk and large succulent leaves springing and thickening so rapidly, that they have not room to unfold themselves, but gather into a *heart* or cluster several feet in circumference, and he will have some idea of the metamorphic adaptation of vegetable life. It is owing to the Protean nature of this organ that we have puckered leaves, as in the curled cress and curled savoy; and that we have notched and lobed ones, becoming simple and entire.

The metamorphoses which occur in the *floral organs* are also very frequent; and on this feature depends all that variety and beauty which it is now so much the object of the florist to produce. These transformations consist in an increase of the petals, in a conversion of petals into stamens, and in some modification of the colour. What are called *double* flowers are produced by a multiplication of the petals, as in the common varieties of the rose; and *full* flowers are those in which the multiplication is carried so far as to obliterate the stamens and pistil. The rose, for example, produces in a wild state only a single row of petals, surrounding a vast number of yellow stamens; but when cultivated, many rows of petals are formed at the expense of the stamens, which are proportionally diminished. Compare the dog-rose of our hedges with the cabbage or Provence rose of our gardens; or compare the single anemones and ranunculuses of the Levant with the finest Dutch varieties, and see what cultivation has produced. In the one case there are only five diminutive petals; in the other we have hundreds. The wild anemone is scarcely an inch across; the Dutch have reared specimens more than six inches in diameter.

"With regard to *colour*," says Dr Lindley, "its infinite changes and metamorphoses in almost every cultivated flower can be compared to nothing but the alterations caused in the plumage of birds, or in the hairs of animals by domestication. No cause has ever been assigned for these phenomena, nor has any attempt been made to determine the cause in plants. We are, however, in possession of the knowledge of some of the laws under which change of colour is effected. A blue flower will change to white or red, but not to bright yellow; a bright yellow flower will become white or red, but never blue. Thus the hyacinth, of which the primitive colour is blue, produces abundance of white or red varieties, but nothing that can be compared to bright yellow—the yellow hyacinths, as they are called, being a sort of pale yellow ochre verging to green. Again, the ranunculus, which is originally of an intense yellow, sports into scarlet, red, purple, and almost any colour but blue. White flowers which have a tendency to produce red will never sport to blue, although they will to yellow; the roses, for example, and the crysanthemums."

The changes which the fruit or seed undergoes are also very numerous and obvious. Where, for instance, is there a native grain like wheat, or a native fruit like the apple? In a wild state, the seeds of our cereal grains (wheat, barley, oats, &c.) are thin and meagre; by proper cultivation they are rendered large, plump, and full of farina, so as to become the most important articles of human subsistence. The small globular sour crab of our hedges is the original of the numberless varieties of apples now cultivated by gardeners, each variety differing somewhat in size, shape, colour, and flavour. In like manner with the sloe, which few could detect as the parent of our purple, yellow, and white plums; and so also with the wild cherry, and almost every species of our cultivated fruits and seeds. We not only can change their size, colour, and other external characters, but can transform them from dry, acrid, and noxious fruits, to fleshy, pleasant, and wholesome products.

TRANSMUTATION OF PLANTS.

Curious as the doctrines of metamorphosis may seem, they are founded on physiological principles which we can discover and appreciate. There is nothing surpassing belief in the statement that a stamen is only a leaf transformed and modified to execute a special purpose; nothing incredible in the fact of a leaf composed of cellular tissue being increased by proper treatment from a square inch to a square foot in dimension; but there is something incredible, something beyond all our ordinary conceptions of the uniformity of nature's workings, in the statement that one plant can be transmuted into another; that, for example, barley can be converted into oats, or oats into rye; yet is this doctrine affirmed upon the evidence of certain carefully-conducted experiments.

From the many statements that have been published respecting this curious subject, we select that of Dr Weissenborn as being the most emphatic, and as containing all that is yet really known and worthy of credit:—"With reference to the transformation of oats into rye, this remarkable phenomenon has not only been verified by new experiments, but we have caused beds to be sown with oats, in order that we may be able to convince disbelievers, by producing rye-stalks which have sprung from the crown, that still shows the withered leaves of the oat plant of the previous year. I repeat that this transformation does take place, if oats are sown very late (about midsummer), and cut twice as green fodder before shooting into ear; the consequence of which is, that a considerable number of oat plants do not die in the course of the winter, but are changed in the following spring into rye, forming stalks that cannot be known from those of the finest rye. We must expect that this fact will be considered by many as a mere assertion; and there are others still in doubt about it. The latter, however, own that they have either not made the experiment, or have sown their oats too early, and therefore had cut them oftener than twice, in order to prevent their running into ear, whereby the plant loses the power of surviving the winter, and of being transformed into rye. I cannot notice such adversaries as reject the result without having put it to the test of experiment, or who rest their opposition on experiments that have not been conducted in the right manner. *Let any one sow oats during the latter end of June, and the transformation in question will certainly take place!* The time of sowing the oats did not formerly appear of paramount importance, nor was it believed that it could make any difference whether the oats were cut more than twice; in consequence of which a few experiments have failed. Now, however, we must conclude that if the transformation occasionally takes place with oats that have been sown too early, that is merely an accident depending on a peculiar state of the weather or other casualties, whereas the result is quite certain if the oats are sown towards the end of June. If the soil is too dry about that time, one of the reporters on the subject to the Agricultural Society of Coburg concludes, from an experiment he made in 1837, that one watering, so as to enable the oats to germinate, may be recommended; although, if this is done repeatedly, the high temperature of the season will cause the plants to grow so luxuriantly, that it becomes necessary to cut them three times when about one and a-half foot high, to prevent them forming their ear, whereby the object would be wholly or partially lost. If, however, among those who doubt the fact, there be found people who pity us because we trust more to actual experiment than to theory, we should almost feel tempted to pity theorists whose self-sufficiency has prevented them from thoroughly investigating an important phenomenon which was noticed so many years ago. Nor can

Oats and Rye.

we commend the discernment of such as are unable to discover in the plants in question both the preceding year's dry stubble and leaves of the oats, and the fresh stalks and leaves of the rye, which latter form in May upon the crown of the oat plant, and produce fine winter rye. The society (of Coburg) takes credit to itself for perseverance, in having struggled against the opinion of the public for several years, in order to establish a fact which no physiologist would believe, because people are always apt to confound the laws of nature with those of their systems."

The common faith of naturalists is, that what they call a *species* is immutable; in other words, that any animal or plant will give birth to others only of its own species. But what is a species? Are we so familiar with nature's secrets as to determine absolutely what are species and what varieties. The advocates for transmutation in plants do not expect, we presume, that a cow will ever give birth to a horse, or that an oak will spring from the seed of an apple. They merely affirm that many plants now regarded as distinct species, or even genera, may be made, under certain conditions, to assume the characteristics of each other; and they point to the transmutation of oats into rye—both belonging to the same natural order, *Gramineæ*—as evidence of their assertion.

Having thus given a hasty sketch of the principles regulating the growth, reproduction, and dispersion of plants, we shall now advert to some of the more wonderful results as regards their size, longevity, sensation, and other phenomena.

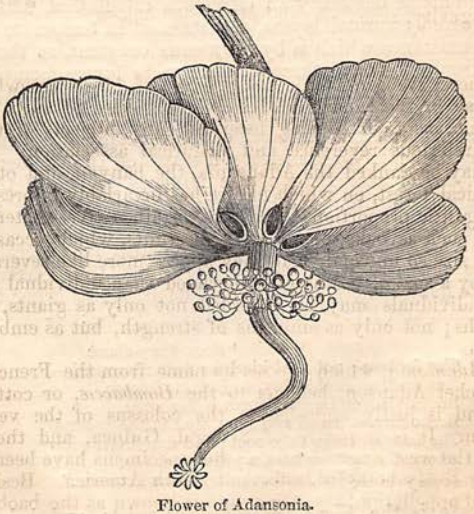
GIANT PLANTS.

As there are some orders of plants of larger growth than others, so in the same order there are species of such colossal dimensions as to have long been not only subjects of wonder, but of religious reverence and historical association. Among these may be ranked the Adansonia, the banyan, and others of the tropical forest, on which nature has invariably impressed the most gigantic proportions; and also certain natives of temperate regions, such as oaks, planes, and chestnuts, which occasionally attain a size so unusual, that they appear more like several trees united by a sort of Siamese brotherhood than individual trunks. Such individuals may be regarded not only as giants, but as patriarchs; not only as emblems of strength, but as emblems of duration.

The *Adansonia*, which derives its name from the French botanist Michel Adanson, belongs to the *Bombaceæ*, or cotton-tree tribe, and is justly regarded as the colossus of the vegetable kingdom. It is a native of Senegal, Guinea, and the countries on the west coast of Africa; but specimens have been found growing freely both in India and South America. Besides its botanical appellation, the Adansonia is known as the baobab, the monkey bread tree, and the Egyptian sour gourd. The height of the trunk is moderate, varying from 50 to 60 feet, but its lateral bulk is almost incredible. In 1756, Adanson met with trunks in Senegambia having a diameter of 30 feet and a circumference of 90; and Mr Gilberry observed one having a circumference of 104 feet, though its height did not exceed 30. The branches are of considerable size, and 50 or 60 feet long; the central branch rises perpendicularly, the others spread round it in all directions; and their extremities being bent towards the ground by the weight of foliage, the whole tree presents the appearance of a vast hemispherical mass of verdure 140 or 150 feet in circumference (see fig). In seed, a full-grown Adansonia seen at a distance almost

Adansonia, or Baobab Tree.

presents the appearance of a forest; and it is not till the spectator has satisfied himself by a near inspection, that he can be



Flower of Adansonia.

convinced that the luxuriant verdure above proceeds from a solitary stem. The leaves, which closely resemble those of the horse-chestnut, are of a deep green: and it is said that Cape de Verd (literally, the Green Cape) takes its name from the circumstance of its being clothed with these gigantic trees. The flowers are white and pendent, and, as may be expected from the size of the tree, very large, measuring, when fully expanded, from 4 to 6 inches in diameter. A full-grown Adansonia, clothed with its brilliant verdure and snowy blossoms, must therefore present a most magnificent spectacle; and we can fully appreciate the feelings that prompt the untutored negro to worship under its shade, and hail the opening of the flowers with a pious good-morning. Another consideration connected with the baobab is the great age to which many individuals must arrive, as may be inferred from their enormous bulk. It is no doubt a very rapid grower, for a specimen in the Botanic Garden at Calcutta is said to have attained a circumference of 18 feet in twenty-six years; but when we multiply this ten or twentyfold, and make allowance at the same time for the slower increase of maturity, we can readily believe that many specimens now extant may have witnessed the revolutions of more than 2000 years. Adanson indeed looks upon it as the oldest living monument on the globe; and taking his data from two specimens which he examined in 1761, he calculates that some of the baobabs then flourishing on the coast of Africa might have existed for 5000 years! This is obviously an erroneous calculation, founded on the increase by annual layers, as witnessed in temperate regions —a circumstance which is by no means constant, as there may in the tropics be two, three, or even more layers formed in one year, according to seasonal influences; but even after the necessary deductions, we are compelled to regard the Adansonia as alike the monarch and patriarch of the vegetable kingdom.

Among the many astonishing features of Indian vegetation, the *Banyan*, or sacred fig of the Hindoos, is one of the most curious and beautiful. Its branches bend towards the ground, take root, and thus form separate trees, which successively cover a vast space of ground, and furnish an agreeable and extensive shade in warm climates. Milton thus correctly describes its habit, where he speaks of its leaves as being those of which Adam and Eve "made themselves aprons:"—

> "Soon they chose
> The fig tree; not that kind for fruit renowned—
> But such as at this day, to Indians known,
> In Malabar or Deccan, spreads her arms,
> Branching so broad and long, that in the ground
> The bended twigs take root; and daughters grow
> About the mother tree, a pillared shade,
> High over-arched, and echoing walks between."

The banyan is the *Ficus Indica* of botanists, and belongs to the *Artocarpeæ*, or bread-fruit tribe. A specimen is mentioned by Marsden as growing in Bengal, which had fifty or sixty stems, with a total diameter of 370 feet, and which afforded at noon a shadow, the circumference of which was 1116 feet. There is another yet more gigantic still standing on the island of Nerbuddah, near Baroach, called the *Cubbeer Burr*. The tradition of the natives is, that this tree is 3000 years old; and it is supposed by some to be the same that was visited by Nearchus, one of Alexander the Great's officers. The large trunks of this tree amount in number to 350; the smaller ones exceed 3000; and each of these is continually sending forth branchlets and hanging roots to form other trunks. The circumference of this remarkable plant is nearly 2000 feet. Roxburgh states that he found the banyan in the greatest perfection and beauty about the villages on the skirts of the Circar Mountains, where he saw some individuals 500 yards round the circumference of the branches, and 100 feet high; the principal trunk being more than 20 feet to the branches, and 8 or 9 feet in diameter. Though undoubtedly a tree of wonderful dimensions, the banyan must be regarded as a succession of independent stems rather than as a single individual; for it is evident that some of the earlier rooting-branches may exceed the parent trunk in size, and that any of them being once rooted, would live and send forth new branches in arches and colonnades though the original stem were utterly destroyed.

The *Dracæna* or *Dragon Tree* is another of those gigantic plants which give character to the vegetation of intertropical countries. It is found abundantly in the East India islands, in the Canaries and Cape Verds, and along the coast of Sierra Leone. In ordinary cases, the erect trunk of the dracæna does not exceed twelve or fourteen feet, but divides into a number of short branches, each ending in a tuft of spreading sword-shaped leaves, pointed at the extremity. The tree is palm-like in its growth, but belongs to the asparagus tribe of Jussieu, or, according to Dr Lindley, to the *Liliaceæ*. It does not increase by external layers like the oak and fir, but enlarges after the manner of the palm, and therefore has not a trunk of true durable timber; nevertheless, some specimens have been known to grow to an enormous size, and to endure for many centuries. The most celebrated specimen on record is that of Orotava, in the island of Teneriffe, which in 1799 was found by Humboldt to be 45 feet in circumference, and about 50 or 60 feet in height. "The trunk," says the baron, "is divided into a great number of branches, which rise in the form of a candelabra, and are terminated by tufts of leaves, like the yucca which adorns the valleys of Mexico. It still bears every year both leaves and fruit. Its aspect feelingly recalls to mind 'that eternal youth of nature' which is an inexhaustible source of motion and of life." Though continuing thus to grow, this tree had not perceptibly increased in size during the life of the oldest inhabitant, as its top branches, from the brittle nature of the wood, were constantly being broken down by the winds. In 1819 the greater part of its top was blown down; and in 1822 the venerable trunk was entirely laid prostrate by a tempest. The enormous bulk of this wonderful vegetable was noted so early as the time of Bethencourt, in 1402, who described it as large and as hollow as it was found by Humboldt; hence the latter infers that, along with the Adansonia, the dracæna of Orotava was one of the oldest inhabitants of our globe.

The *Courbarils* of the primeval forests of Brazil are thus spoken of by Von Martius:—"The place where these prodigious trees were found appeared to me as if it were the portal of a magnificent temple, not constructed by the hands of man, but by the Deity himself, as if to awe the mind of the spectator with a holy dread of His own presence. Never before had I beheld such enormous trunks: they looked more like living rocks than trees; for it was only on the pinnacle of their bare and naked bark that foliage could be discovered, and that at such a distance from the eye, that the forms of the leaves could not be made out. Fifteen Indians, with outstretched arms, could only just embrace one of them. At the bottom they were 84 feet in circumference, and 60 feet where the boles became cylindrical!" We know too little of these vegetable leviathans to give a more minute account; but if they are as Martius describes, they may be justly considered as rivalling the Adansonias both in point of age and dimensions.

Passing from trees of strange habit and growth, only familiar to the inhabitants of the tropics, we shall now advert to some which are common in European forests, and which occasionally attain dimensions little if at all inferior to the baobabs and banyans of India and Africa. Among these we may notice, in the first place, the *cypress*, *yew*, and *cedar*, which respectively belong to the *Coniferæ*, or fir tribe, and which are all remarkably long-lived and enduring. The largest known specimens of the cypress are to be met with in Mexico. At Atlexo, for instance, there is one said to be 76 feet in girth; and another at St Maria del Tuli, which is 118 feet in circumference! This is larger, certainly, than any of Adanson's baobabs; "but," says Humboldt, on examining it narrowly, "M. Anza discovered that what excites the curiosity of travellers is not a single individual, but three united trunks." There is, however, at Chapultepec, in the same region, a third cypress, which is said to be 117 feet 10 inches round; and the younger De Candolle considers it even older than any of the baobabs of Senegambia. Michaux, who published a splendid work on the forest trees of America, says that the largest stocks of the cypress are 120 feet in height, and from 25 to 40 feet in circumference above the conical base, which, at the surface of the earth, is always three or four times as large as the continued diameter of the trunk. In the East, the cypress is the emblem of mourning, and is generally to be found overshadowing with its dark branches the spots consecrated to the dead; and it is owing to the respect which they meet with in such situations that so many gigantic and venerable specimens have been allowed to survive. Nearly allied to the cypress, and applied to the same funereal purposes, is the yew tree of our own country, which often attains to enormous dimensions. That of Hedsor, in Bucks, measures about 27 feet in diameter, and is still in full health and vigour; that of Fortingal, in Perthshire, mentioned by Pennant in 1770, was 21½ feet in diameter; those of Crowhurst, in Surrey, were more than 11 feet; and those of Fountain Abbey, in Yorkshire, well known so early as 1155, about the same dimensions. Respecting the cedar of Lebanon, Maundrell tells us that when he went into the East, a few of the old trees were then growing on the loftiest parts of the mountains. Measuring one of the largest, he found it to be 36 feet in girth, and 111 feet in the spread of its boughs. About 18 feet from the ground it divided into 5 limbs, each of which equalled in bulk an ordinary tree. The cedar, like the yew and cypress, is an evergreen, and occupies a pre-eminence over all other trees in the East in point of beauty and duration.

Belonging to the same natural order we may mention the Norfolk pine, or *kauri*, of the New Zealanders, which occasionally grows to a very large size. Mr Terry, in his recently published work on New Zealand, mentions two extraordinary individuals which he saw on the eastern coast, near Mercury Bay, and which were supposed to be the largest on the island. The available trunk of one, which was cut down and brought to England, was 150 feet in length, and 25 feet in circumference at the base; the other is still standing, and is called by the natives the Father of the kauri. "Although almost incredible, it measures 75 feet in circumference at its base! The height is unknown, for the surrounding forest is so thick, that it is impossible to obtain an accurate view of the tree. There is an arm some distance from the trunk, which measures 6 feet in diameter at its junction with the main stem." Some of our own native pines, such as those of Glenmore and Athole, have reached to a great age and size; but they are mere saplings compared with this "Father of the kauri."

The *Oak*, *Chestnut*, and *Beech*, though differing considerably in external aspect, belong to the same natural order, namely, *Corylaceæ*, or *Cupuliferæ*, so called from the cup or cupule in which the fruit is contained, as is well illustrated by the common acorn. They are excellent timber trees, generally flourishing for centuries, and growing to a large size, sometimes attaining proportions truly colossal, and outliving dynasties and kingdoms. As a complete record of celebrated oaks would require several volumes, we shall merely allude to some of the more remarkable found in Britain. The *Shire Oak*, which grew near Worksop, deserves honourable mention, in respect both of its own dignity and that of its situation. In point of grandeur, few trees equalled it. Its boughs overspread a space of 90 feet in diameter—an area capable, on mathematical calculation, of containing 235 horse. It stood on a spot where the counties of York, Nottingham, and Derby unite, and spread its shade over a portion of each. From the honourable station of thus fixing the boundaries of three large counties, it was equally respected through the domains of them all, and was known far and wide by the honourable distinction of the Shire Oak, by which appellation it was marked on all the larger maps of England. *Fairlop*, known for centuries as the monarch oak of Hainhault Forest, in Essex, has attained dimensions even still more gigantic. The tradition of the country traces it half way up the Christian era. It is still a noble tree, though it has now suffered greatly from the depredations of time. About a yard from the ground, where its rough fluted stem is 36 feet in circumference, it divides into eleven vast arms, yet not in the horizontal manner of an oak, but rather in that of a beech. Beneath its shade, which overspreads an area of 300 feet in circuit, an annual fair was held on the 2d of July, and no booth was suffered to be erected beyond the extent of its boughs. "Honours, however," says Kirkby, "are often attended with inconveniences, and Fairlop has suffered from its honourable distinctions. In the feasting that attends a fair, fires are often necessary; and no place seemed so proper to make them in as the hollow cavities formed by the heaving roots of the tree. This practice has brought speedier decay on Fairlop than it might otherwise have suffered." The next we shall mention is *Damory's Oak*, which formerly grew not far from Blandford, in Dorsetshire, and five or six centuries ago was probably in its maturity. At the ground, its circumference was 68 feet, and 17 feet above the ground its diameter was four yards. As this vast trunk decayed, it became hollow, forming a cavity which was 15 feet wide and 17 feet high, capable of holding twenty men. During the civil wars, and till after the Restoration, this cave was regularly inhabited by an old man, who sold ale in it. The tree suffered greatly during the storm of 1703, by which several of its noblest limbs were broken down; and in 1755, the remnants of the venerable trunk were sawn asunder and sold as firewood. The *Skelton Oak*, near Shrewsbury, in sight of which the famous battle betwixt Henry IV. and Hotspur was fought in 1403, is still standing, and in foliage. It is 37 feet in circumference at a foot and a half from the ground, and is otherwise proportionally large. It divides into two enormous limbs, both of which have been fractured; and the lower portion of the trunk is hollowed out into a recess capable of accommodating a dozen persons.

One of the noblest trees on record is a chestnut upon Mount Ætna, though it has now lost much of its original dignity. Many travellers have taken notice of this extraordinary tree. Brydone, who wrote his account in 1771, says it had then the appearance of five distinct trees, the space between which, he was assured, had once been filled with solid timber. The possibility of this he could not at first conceive; for the five trees together spread over a space of 204 feet in diameter. At length, however, by an examination, he was convinced that at one period these had been but one mighty tree; and he found that this chestnut was of such renown, that it appeared marked in an old map of Sicily, published a hundred years before; and an account of it at that period is given by Kircher, fully corroborating its dimensions. The great chestnut which stood at Finhaven, in Forfarshire, was long accounted the largest tree in Scotland. In 1744, the measures of this remarkable trunk were taken before two justices of the peace, when the circumference at half a foot from the ground was 42 feet 8½ inches. A chestnut cut down at Kinfauns Castle in 1760 was 22½ feet in girth; and there is at present a beautiful chestnut at Riccarton, in Edinburghshire, full 27 feet in circumference; its branches covering an area of 77 feet in diameter. There are also several measurements of gigantic beeches on record; but of these our space will not allow us to take even a passing glance.

GIGANTIC FLOWERS AND LEAVES.

Of the blossoms which adorn our conservatories and gardens, those of the rose, the peony, the dahlia, hollyhock, and passion-flower, are amongst the most showy and gigantic. These, however, are but mere pigmies to many that are found in other lands, where excess of light and sunshine call into existence myriads of flowers as remarkable for size as they are exuberant in colour and fragrance. The largest and most perfect yet discovered and described is that of *Victoria Regia*, belonging to the *Nymphеæ*, or water-lily tribe, the leaves of which measure above 18 feet, and its flower nearly 4 feet in circumference! It was met with in British Guiana, in 1837, by Mr Robert Schomburgk, who thus speaks of his discovery :—"It was on the 1st of January this year, while contending with the difficulties of nature, opposed in different forms to our progress up the river Berbice, that we arrived at a point where the river expanded and formed a currentless basin. Some object on the southern extremity of the basin attracted my attention. It was impossible to form any idea of what it could be; and animating the crew to increase the rate of their paddling, we were shortly afterwards opposite the object which had raised my curiosity—a vegetable wonder! All calamities were forgotten; I felt as a botanist, and felt myself rewarded. A gigantic leaf, from 5 to 6 feet in diameter, salver-shaped, with a broad rim, of a light green above, and a vivid crimson below, resting upon the water. Quite in character with the wonderful leaf was the luxuriant flower, consisting of many hundred petals, passing in alternate tints from pure white to rose and pink. The smooth water was covered with the blossoms, and as I rowed from one to the other, I always observed something new to admire. The leaf, on its upper surface, is a bright green, in form almost orbicular, except that on one side it is slightly bent in; its diameter measured from 5 to 6 feet. Around the whole margin extended a rim from 3 to 5 inches high; on the inside light green, like the surface of the leaf; on the outside, like the leaf's lower surface, of the brightest crimson. The calyx is four-leaved, each sepal upwards of 7 inches in length and 3 inches in breadth; at the base they are white inside, reddish brown and prickly outside. The diameter of the calyx is from 12 to 13 inches; on it rests the magnificent corolla, which, when fully developed, completely covers the calyx with its hundred petals. When it first opens, it is white, with pink in the middle, which spreads over the whole flower the more it advances in age, and it is generally found the next day altogether of a pink colour: as if to enhance its beauty, it is sweet-scented. We met the plants frequently afterwards; and the higher we advanced, the more gigantic they became. We measured a leaf which was 6 feet 5 inches in diameter, its rim 5½ inches high, and the flower across 15 inches!"

Of more colossal dimensions than the Victoria, but inferior in organisation, is the *Rafflesia Arnoldi*, a native of the hot damp jungle of Sumatra. This plant grows parasitically on a kind of vine, and in structure is intermediate between the fungi and the endogens, forming one of the rhizanths, or root-flowers, which have no true stem or leaves. It was discovered in 1818 by Dr Joseph Arnold, and named after Sir Stamford Raffles, then governor of that island. The discoverer thus describes it:—"At Pulo Lebban, on the Manna river, I rejoice to tell you I met with what I consider the greatest prodigy of the vegetable world. I had ventured some way before the party, when one of the Malay servants came running to me with wonder in his eyes, and said, '*Come with me, sir, come!—a flower, very large, beautiful, wonderful!*' I went with the man about a hundred yards into the jungle, and he pointed to a flower growing close to the ground, under the bushes, which was truly astonishing. My first impulse was to cut it up, and carry it to the hut. I therefore seized the Malay's parung, and found that the flower sprung from a small root which ran horizontally (about as large as two fingers). I soon detached it. To tell you the truth, had I been alone, and had there been no witnesses, I should, I think, have been fearful of mentioning the dimensions of this flower, so much does it exceed any other I have heard of; but I had Sir Stamford and Lady Raffles with me, and Mr Palsgrave, who, though equally astonished with myself, yet are able to testify as to the truth. The whole flower was of a very succulent substance, the petals and nectary being in few places less than a quarter of an inch thick, and in some places three quarters of an inch. It measured a full yard across, the petals being 12 inches high, and a foot apart from each other. The nectarium, in the opinion of us all, would hold twelve pints, and the weight of this prodigy we calculated to be fifteen pounds."

Besides these floral Titans, of which we have given details, there are many other gigantic blossoms to whose dimensions we can merely advert. The flowers of the *Aristolochiæ*, or birthworts of tropical America, are often from 15 to 16 inches across, and are large enough to be drawn over the heads of the Indians, who make caps of them in their sports. The *Magnolia Grandiflora*, or tulip tree of the French Canadians, is not less remarkable for the size of its leaves and flowers than for its lofty stature. Its trunk is commonly straight, and not unfrequently 90 feet in height, and about 3 in diameter, having a fine pyramidal head of foliage and blossom. Its leaves are like those of the laurel, but much larger, being 8 or 9 inches in length; the flowers are white, 7 or 8 inches in diameter, and of an agreeable odour. They are larger than those of any other tree with which we are acquainted, and on detached trees are exceedingly numerous, rendering the magnolia one of the most superb productions of the vegetable kingdom. The *Agavè Americana*, which was at one time regarded as a marvel, is also remarkable for its gigantic panicle of flowers. This plant is often known by the name of the "Great American Aloe," because resembling the aloes in its leaves; but it belongs to the *Bromeliaceæ*, or pine-apple tribe, and has little in common with the aloes. The flowering of the agavè was considered to be of rare occurrence (taking place only once in a century); but this has been disproved—the plant, in good condition, producing terminal flowers in seven or ten years. When these do come forth, they present a most interesting spectacle, the stem rising from 30 to 40 feet high, and bearing hundreds of greenish-white flowers on an elegant branched spike. The panicle, or bunch of fresh flowers, is often 15 feet in height, and is in this respect without a parallel.

Agavè Americana.

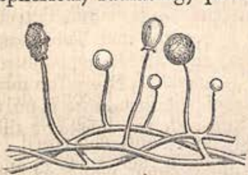
We have already alluded to several gigantic leaves, but all of them fall infinitely short of the dimensions attained by the leaves of the palm family. The largest of which we have an authentic account is that of the Talipàt palm, which grows luxuriantly among the mountains of Ceylon. Knox quaintly speaks of this tree as being "as tall as a ship's mast, and very straight, bearing only leaves, which are of great use to the inhabitants of Ceylon; one single leaf being so broad and large, that it will cover fifteen or twenty men, and keep them dry when it rains." The Rev. H. Caunter says he has seen specimens of the Talipàt 200 feet in height, the leaves of which were 11 feet in length, and 16 in breadth, and the fruit about the size of a twenty-four pound shot. While on the banks of the Calamy, his attention was particularly arrested by several rafts on the river, over which a complete canopy was thrown, formed of a single leaf of the Talipàt, that entirely covered both freight and crew!

MINUTE PLANTS.

As we have vegetables celebrated for their gigantic size, so we have others remarkable for the minuteness and delicacy of their proportions. Nature knows no limit either in the ascending or descending scale: she is as wonderful and perfect in the formation of a fungus, which the unassisted eye cannot detect, as she is in the structure of the oak and cedar, which command our veneration. With the characters of the latter the botanist has been long familiar, because their dimensions more forcibly arrest the eye of sense; to the structure of the former he is only beginning, as it were, to have access through the lenses of the microscope.

One of the most extraordinary of microscopic plants is the *Achlya prolifera*, whose soft silky threads may sometimes be seen adhering to the surface of gold-fishes, and covering them, as it were, with a whitish slime. This appearance is generally looked upon as a species of decay or consumption in the animal itself, and not as an external clothing of parasitic plants. It is, however, a true vegetable growth, each individual consisting of a single filament, with a minute pear-shaped ball on the top, containing numerous grains, which are the seeds or embryos of future plants. The green slime, which in summer gathers over the surface of stagnant water, is of the same order of vegetation; namely, *Confervæ*—an order entirely dependent upon water for their growth and propagation, and to which drought is certainly fatal. The *achlya* has been examined by Dr Unger, who describes it, when at its full growth, as consisting of transparent threads of extreme fineness, packed together as closely as the pile of velvet, and much resembling, in general appearance, certain kinds of mouldiness. When placed under the microscope—for the unassisted eye can perceive nothing of its true construction—each thread is terminated by the pear-shaped ball already alluded to, which is about 1-1200th of an inch in diameter, and consists of a single cell filled with a mucilaginous fluid, in which float the procreative granules. The contents of this cell are seen to be in constant motion from the earliest stage of their existence; but as they advance to maturity, the mucilage disappears, and then the motion of the granules becomes more rapid and violent, till ultimately they burst their way through the cell, and are transferred to the water, there to perform their circle of being, and to give birth to new races of granules. All this takes place with such amazing rapidity, that we are assured an hour or two suffices for the complete development and escape of the spores; so that we need not wonder when we are told that, once established, the *Achlya prolifera* will often complete the destruction of a healthy gold-fish in less than twelve hours.

Another of these curious parasites is the *Mucor mucedo*, which abounds in bruised fruit and other substances containing fecula or sugar. It belongs to that portion of the fungi generally known under the name of moulds, of which that on stale bread, the ergot of rye, the rust, mildew, and smut in wheat, are familiar examples. These moulds are of all shapes—simple, branched, spherical, radiating, presenting a surface like velvet, or a network of the most delicate texture; and of all hues—green, blue, yellow, and vermilion. The *Mucor mucedo* consists of a single filament, headed by a very minute ball-shaped receptacle. In the young state, this little ball is covered by a thin membrane, which bursts as the spores arrive at maturity, which then present themselves like so many dusty particles congregated round a central nucleus. Being so minute, the slightest touch or the gentlest breath of air is sufficient to scatter them in thousands; and thus the mucors increase with amazing rapidity. As they require abundant nutriment, it is only on succulent parts that they luxuriate, and for this reason they are principally injurious to fruits—the slightest injury from an insect affording them a basis for propagation.


Mucor Mucedo.

From the examples we have just given, it must not be supposed that plants of microscopic dimensions are to be found only among parasitic fungi. There are others equally minute, and still more wonderful in the aggregate, which are of independent growth, and which twine and interlace their tiny branches into a net-work as tough as the strongest felt, and extending over many yards of surface. These are the freshwater confervæ, of which the substance called "water-flannel" may be taken as a well-known example. A specimen is thus described by a correspondent of the Gardeners' Chronicle for

1843:—"A friend put into my hand the other day a yard or two of what seemed a coarse kind of flannel, gray on one side, and greenish on the other, and a full quarter of an inch in thickness. It had been thrown up by the river Trent, and washed ashore in vast sheets. Those who had seen it pronounced it a manufactured article: and so it was, but by the hand of nature. When this substance is handled, it is harsh to the touch, although composed of the finest threads. To the naked eye, it presents no character by which it may be known from any coarse and loosely-woven cloth. The microscope reveals its nature. It is then found to consist of myriads of jointed threads, whose joints are compressed alternately sideways and vertically; they are here and there transparent, but for the most part opaque and rough to the eye. The white side is more opaque than the other, and more unexaminable; but if a little muriatic acid be added to the water in which the fragments of water-flannel float, copious bubbles of air appear. These are bubbles of carbonic acid, extricated by the action of the muriatic acid on a coating of carbonate of lime, with which the plant is more or less completely invested. If, after this operation, the threads are again examined, the contents of the joints become visible: in the green parts of the flannel, they were filled with an irregular mass of green matter; in the white part with myriads of globules, intermixed with a shapeless substance. The globules are the seeds. If a little iodine is then given to the flannel, it is readily absorbed; and the contents, shapeless matter, globules, and all, become deep violet, showing that all this substance is starch. Hence it appears that the water-flannel is a microscopic plant, composed of jointed threads, secreting carbonate of lime on their surface, and forming seeds composed of starch within them. And when we consider that the joints are smaller than the eye can detect, while each contains from fifty to one hundred seeds, it may easily be conceived with what rapidity such a plant is multiplied. Besides which, as their contents consist to a great extent of starch, the most readily organisable of vegetable materials, the means of growth with which the plant is provided are far more ample than anything we know of in the higher orders of the vegetable kingdom." This vegetable swarms on stagnant pools, where it lives on the decaying matter which all waters more or less contain, and thus tends to their purification, the while that its own substance forms food for myriads of animalcules that wander over its trackless fields and endless mazes.

Here, however, we must close our record of microscopic plants, which, it will be seen, belong chiefly to the mosses, lichens, fungi, and other forms of flowerless vegetation. Zoologists tell us, when speaking of animalcules, that not a drop of stagnant water, not a speck of vegetable or animal tissue, but has its own appropriate inhabitants. The same may be remarked of plants; for we cannot point to a speck of surface, unless chilled by everlasting cold, or parched by continuous drought, that has not its own peculiar vegetation. The spores or seeds of these minute parasites are almost infinitesimally small: they are floating above and around us, unperceived by the naked eye, ready to fall and germinate wherever fitting conditions are presented. Nay, as certain changes in animal tissue are ascribed to animalcules, so have certain changes in organised substances, such as fermentation, been ascribed to vegetable growth. Yeast, according to this view, is a true vegetable, consisting of minute organised cells or spherules, which propagate with amazing rapidity so long as they find their proper nutriment in the fermenting liquid. Nor is there anything more incredible in the fact, that the little globular yeast plant should extract its nutriment from the fluid on which it floats, than that the water-flannel should extract its starch or lime from the water which it covers.

PECULIAR PLANTS.

Under this head we comprehend such plants as stand out in bold relief from the rest of the vegetable kingdom for some noted peculiarity in structure, habits, or properties. It is true that every plant has its own specific distinctions; but there are several which seem to stand apart as the curiosities of vegetation, just as the ornithorhyncus and giraffe stand isolated among animals. They have no congeners in the peculiarity that renders them remarkable.

The cow tree, or palo de vaca of South America, is one of the most interesting of this class. It is known to botanists as the *Galactodendron utile*, or useful milk tree, and belongs to the *Urticaceæ*, or nettle tribe, the herbaceous members of which have their juice thin and watery, while in the ligneous species it is milky and viscous. The cow tree is a native of the Caraccas, and grows in rocky situations at an elevation of nearly 3000 feet. It is thus described by Baron Humboldt :—" On the barren flank of a rock grows a tree with dry and leathery leaves; its large woody roots can scarcely penetrate into the stony soil. For several months in the year not a single shower moistens its foliage. Its branches appear dead and dried ; yet, as soon as the trunk is pierced, there flows from it a sweet and nourishing milk. It is at sunrise that this vegetable fountain is most abundant. The natives are then to be seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow, and thickens at the surface. Some drain their bowls under the tree, while others carry home the juice to their children ; and you might fancy you saw the family of a cowherd gathering around him, and receiving from him the produce of his kine. The milk obtained by incisions made in the trunk is glutinous, tolerably thick, free from all acridity, and of an agreeable and balmy smell. It was offered to us in the shell of the trituros or calabash tree. We drank a considerable quantity of it in the evening before going to bed, and very early in the morning, without experiencing the slightest injurious effect. The viscosity of the milk is the only thing that renders it somewhat disagreeable. The negroes and free labourers drink it, dipping into it their maize or cassava bread." Sir R. Kerr Porter describes the palo de vaca as a tree of large dimensions, mentioning that he measured one somewhat more than 20 feet in circumference at about 5 feet from the root. This colossal stem ran up to the height of 60 feet, perfectly uninterrupted by either leaf or branch, when its vast arms and minor branches, most luxuriantly clothed with foliage, spread on every side fully 25 or 30 feet from the trunk, and rose to an additional height of 40 feet, so that this stupendous tree was quite 100 feet high in all. Others were seen at a distance of still larger dimensions.

Equal in utility with the cow tree in yielding an agreeable beverage, but belonging to a very different order, is the ravanala, or traveller's tree of Madagascar. This curious plant belongs to the same tribe as the plantain and banana; namely, the *Musaceæ*, and is known to botanists by the name of *Urania speciosa*. It forms a striking feature in the scenery, as it does in the economy of its native country, and is thus described by Mr Backhouse in his recent Visit to the Mauritius and South Africa:—"Clumps of these trees, composed of several stems rising from the same root, are scattered over the country in all directions. The trunks, or, more properly, root-stocks, which are about 3 feet in circumference, sometimes attain to 30 feet in height; but whether of this elevation, or scarcely emerging above ground, they support grand crests of leaves of about 4 feet long and 1 foot wide, but often torn into comb-like shreds. The head is of a fan-like form, and the flowers, which are not striking for their beauty, are white, and produced from large horizontal green sheaths. The footstalks of the leaves, which are somewhat shorter than the leaves themselves, yield a copious supply of fresh water, very grateful to the traveller, on having their margin cut away near to the base, or forced from contact with those immediately above them, especially those about the middle of the series. The root-stock is of a soft cellular substance, and the fruit, which resembles a small banana, is dry, and not edible. This remarkable vegetable production is said to grow in the most arid countries, and thus to be provided for the refreshment of man in a dry and thirsty land. Probably the water may originate in the condensation of dew, and be collected and retained by the peculiar structure of the leaf: it has a slight taste of the tree, but is not disagreeable."

The *Pitcher-Plant*, or *Nepenthes distillatoria*, is another of those fluid-containing plants whose structure and adaptation strike us with wonder and admiration. It is the type of the recently-established order *Nepenthaceæ*, and is commonly met with in Ceylon and other islands of the East, where it is known by the appropriate name of pitcher-plant, on account of the singular flagon-shaped appendage which holds the water. "Being the inhabitant of a tropical climate," says Barrow in his Cochin-China, "and found on the most dry and stony situations, nature has furnished it with the means of an ample supply of moisture, without which it would have withered and perished. To the foot-stalk of each leaf, near the base, is attached a kind of bag, shaped like a pitcher, of the same consistency and colour as the leaf in the early stage of its growth, but changing with age to a reddish purple. It is girt round with an oblique band or hoop, and covered with a lid neatly fitted, and moveable on a kind of hinge or strong fibre, which, passing over the handle, connects the vessel with the leaf. By the shrinking or contracting of this fibre, the lid is drawn open whenever the weather is showery or dew falls, which would appear to be just the contrary of what usually happens in nature, though the contraction probably is occasioned by the hot dry atmosphere; and the expansion of the fibre does not take place till the moisture has fallen and saturated the pitcher. When this is the case, the cover falls down, and it closes so firmly, as to prevent any evaporation taking place. The water, when gradually absorbed through the handle into the foot-stalk of the leaf, gives vigour to the leaf itself, and sustenance to the plant. As soon as the pitchers are exhausted, the lids again open, to admit whatever moisture may fall; and when the plant has produced its seed, and the dry season fairly sets in, it withers, with all the covers of the pitchers standing open." The accompanying figure represents a leaf of the nepenthes, with

its curious appendage and fittings, than the structure of which nothing could be more thoroughly adapted for accomplishing the end in view.

Under this head may be mentioned the shea, or butter tree, from the kernel of which the Africans extract a fatty substance that is whiter, finer, and equal in flavour to the best butter made from cow's milk, with this advantage, that it will keep without salt for many months; the tallow tree, or candleberry myrtle, the nut of which yields a waxy substance used in the manufacture of candle in America; the India-rubber tree, from the thickened juice of which caoutchouc is obtained; the bread-fruit; and many others; but as these have been noticed in various popular works, and as our space is limited, we pass on to the curious phenomena of

HEAT AND LUMINOSITY IN PLANTS.

We are aware that warm-blooded animals have the power of keeping up a certain temperature within them, which varies at certain stages of their growth, and perhaps periodically. This result is obtained by respiration—the oxygen of the atmosphere uniting with the carbon of their blood, and producing a species of combustion. The more fresh air we breathe, the greater the heat of our bodies, so long as we take proper food to afford the carbon. A similar though less understood phenomenon seems to take place in the respiration of plants. Heat is always disengaged when gaseous products are liberated; and as vegetables respire, however slowly, a certain degree of heat must be produced during that process. In germination, heat is sensibly evolved: a piece of ice placed on a growing leaf-bud dissolves, when it would remain unchanged in the open air; and experiment has proved that the surface of growing plants is three or four degrees higher than the surrounding medium. Again, the internal temperature of a large trunk is always higher than the surrounding atmosphere; and though young shoots are sometimes frozen through, the general structure of the wood and bark is such as to conduct heat so slowly, that the internal warmth is never reduced beyond what seems necessary to vitality. During germination, this heat is most perceptible; and though it be rapidly dissipated by the extent of surface exposed to the air, 110 degrees have been noted during malting, and 87 in the flower of a geranium, when the atmosphere was only at 81.

The luminosity of plants—that is, the evolution of light either from living or dead vegetable structure—is a still more curious phenomenon. Flowers of an orange colour, as the marigold and nasturtium, occasionally present a luminous appearance on still warm evenings; this light being either in the form of slight electric sparks, or steadier, like the phosphorescence of the glow-worm. Thus the tube-rose has been observed in sultry evenings, after thunder, when the air was highly charged with electric fluid, to dart small scintillations of lurid flame in great abundance from such of its flowers as are fading. Sometimes the leaves emit the light, as appears by the following record:—"In the garden of the Duke of Buckingham at Stowe, on the evening of Friday, Sept. 4, 1835, during a storm of thunder and lightning, accompanied by heavy rain, the leaves of the flower called *Œnothera macrocarpa*, a bed of which is in the garden immediately opposite the windows of the manuscript library, were observed to be brilliantly illuminated by phosphoric light. During the intervals of the flashes of lightning the night was exceedingly dark, and nothing else could be distinguished in the gloom except the bright light upon the leaves of these flowers. The luminous appearance continued uninterruptedly for a considerable length of time, but did not appear to resemble any electric effect." Certain fungi which grow in warm and moist situations produce a similar phosphorescence; and decaying vegetables, like dead animal matter, have been observed to emit the same kind of luminosity. From these examples, it would appear that the light was sometimes due to electricity, and sometimes to a true phosphorescence, like that of the glow-worm. Luminosity may, however, be produced by actual combustion of the volatile oils, which are continually flying off from certain plants: those of the *Dictamnus albus* will inflame upon the application of a match, so that the bush may thus be enveloped in flames, and yet not be consumed.

MOTION AND SENSATION IN PLANTS.

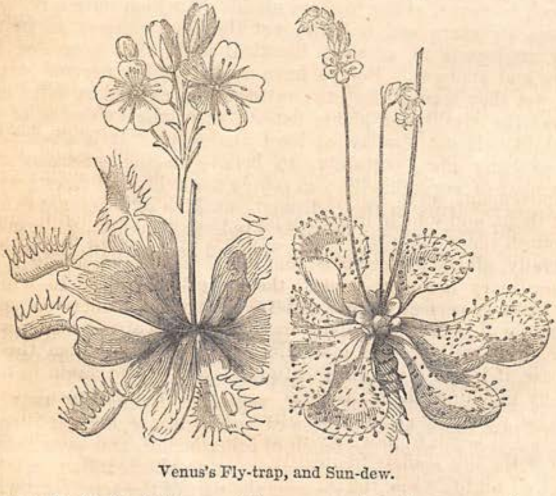
There is no difficulty in understanding what is meant by motion and sensation in animals; they move by muscular contractions and expansions, and feel through their nervous structure. When, however, we speak of motion and sensation in plants, the phenomena assume a more puzzling aspect. Vegetables have, no doubt, woody fibres, sap vessels, spiral vessels, &c.; but then these have no affinity to the veins or muscles of animals. They may serve the same purposes in their economy, but it would be transgressing all rules of sound science to establish an identity between the two sets of organs; to call, for example, these vessels the *nerves* of plants, and to ascribe to them the faculty of sensation, when there is nothing beyond the faintest analogy between their structures. Although plants may not feel, however, as the higher animals do, which have a regular nervous structure and a brain, yet they may possess an irritability analogous to, or even identical with, that possessed by polyps and sponges. Polyps have no discernible nervous structure, yet they seem to feel, to contract, and expand at will; and so may the vitality of plants depend upon the existence of an irritability, if not similar, at least analogous. It is a beautiful and exalting idea, certainly, to believe in the sensation and enjoyment of vegetable life; to people the fields and forests with structures rejoicing in the light and sunshine of summer, exulting in the reproduction of their kind, and becoming dormant during the rigours of winter; to feel and declare with the poet—

> "And 'tis my faith that every flower
> Enjoys the air it breathes."

Science, however, is more rigid and cautious than poetical fancy; and, in the present state of our knowledge, little more can be done than merely to describe the phenomena.

The principal phenomena of vegetable irritability may be divided into three kinds—those caused by atmospheric influence, those depending upon the touch of other bodies, and those which appear to be perfectly spontaneous. Atmospheric influence occasions the closing of the leaves over the part of the tender-growing shoot at night, as may be observed in the chickweed and other common plants, which are then said *to sleep*. The folding of some flowers in the absence of the sun, and the opening of others as soon as that luminary has withdrawn its beams, are ascribable to a similar cause. The white marigold closes its flowers on the approach of rain, and the dwarf celandrina folds up its bright crimson corolla about four o'clock every afternoon. The evening primrose, on the contrary, will not open its large flowers till the sun has sunk below the horizon; and the night-blowing cereus only expands its magnificent blossoms about midnight. Some flowers are so regular in their hours of opening and shutting, that Linnæus formed what he called *Flora's Time-piece*, in which each hour was represented by the flower which opened or closed at that particular time.

The irritability produced by external touch is a familiar, but little understood phenomenon. The movements of the sensitive plant are well known; and it is also known that if the ripe seed-vessels of the noli-me-tangere be touched in the slightest manner, they will open with elasticity, and scatter their contents. The reservoirs which contain the milky juice of the wild lettuce are so remarkably irritable, that the gentlest touch is sufficient to cause it to be ejected from them with considerable force. When this plant is about to flower, if an insect happens to crawl over the surface of the stalk anywhere near to its summit, a jet of viscous milk is propelled, which, if it happens to strike the tiny intruder, glues him to the spot. In the same



Venus's Fly-trap, and Sun-dew.

manner the fruit of the squirting cucumber throws out its seeds and the moist pulp in which they are contained with great violence, and to a considerable distance. The stamens of the barberry, when touched with a pin, spring forward, and appear to make a bow to the stigma, after which they return to their proper position. The most remarkable instance of irritability by contact is that exhibited by Venus's fly-trap, *Dionæa muscipula*, a native of Canada, and nearly allied to the common sun-dew of the British commons. Its flowers have nothing remarkable about them, except that their petals roll up when they are about to decay; but the leaves are very curiously constructed. They have broad leaf-like petioles, at whose extremity are two fleshy lobes, which form the real leaf, and which are armed with strong sharp spines, three on the blade of each lobe, and a fringe of longer spines round the margin, as is shown in the preceding figure. When an insect touches the base of the central spines, the leaf collapses, and the poor insect is caught, being either impaled by the central spines, or entrapped by the others. The leaf then remains closed, the fringe of long spines being firmly interlaced and locked together, till the body of the insect has wasted away. This apparatus being the nearest approach to a stomach which has been yet observed in plants, an experiment was tried some years ago of feeding a dionæa with very small particles of raw meat, when it was found that the leaves closed in the same way as they would have done over an insect, and did not open again till the meat was consumed.

The spontaneous movements of plants are much more difficult to be accounted for than those occasioned by atmospheric influence, or by external touch. We can fancy light and heat contracting or dilating the vessels, and thus occasioning flowers to open or shut, and leaves to fold or unfold; but plants have some movements for which there is apparently no external cause. In the *Hedysàrum gyrans*, for example, which has compound leaves, the terminal leaflet of which never moves except to fold itself close down to its own stalk; but the side leaflets have such eccentric movements, as to render it difficult, if not impossible, to explain them, and which might appear, indeed, to a fanciful mind as though the whole plant were actuated by a feeling of caprice. Generally, all the leaflets twist and whirl themselves about in an extraordinary manner, though the air of the house in which they grow is perfectly still; but frequently the leaflets on only one side will be affected, and sometimes only a single leaflet will move, or all will become motionless together; and when this is the case, it is quite in vain to attempt to set them again in motion by touching them; though sometimes in a moment, as if from the pure love of mischief, after the touching has ceased, the leaflets will begin to move again as rapidly as before. In the like manner the side leaflets frequently continue their eccentric movements all night, while the terminal leaflet remains quietly folded up, and apparently fast asleep. M. Dutrochet ascribes all these movements to an interior and vital excitation; indeed *life* appears to be intimately connected with irritability, as the latter quality exists only in plants in a vigorous condition.

The vitality of plants may be destroyed by giving them deleterious or poisonous substances. These facts have been established principally by the experiments of Marcet and Macaire. Common kidney beans which had been watered with a decoction of arsenic faded in the course of a few hours; they then began to turn yellow, and on the third day were dead. A lilac was also killed by having arsenic introduced into a slit in one of its branches. Mercury, under the form of corrosive sublimate, produced the same effects as arsenic; but when used as quicksilver, no results were observed. Vegetable poisons have been proved to be equally injurious to other plants as mineral ones; a solution of nux vomica killed some kidney beans in the course of a few hours. Prussic acid had the same effect in the course of a day, and deadly nightshade in about four days; while spirits of wine killed the plant to which it was administered in a few hours. These experiments also tend to confirm the idea of sensation in vegetables; in other words, that plants have life more closely analogous to that of animals than most people suppose; that however different their feelings may be from that of ours, that they are at least endowed with sensation; and that the belief in their enjoyment of the air and sunshine may be something more than a mere poetical fancy.

Such is a rapid glance at the more prominent points of a subject which would require as many volumes for its full explanation as we have devoted pages. Our descriptions, imperfect as they are, may serve, however, the useful purpose of directing the attention of many to an unexhaustible field of inquiry, and of the purest and most delightful recreation. The study of nature is open to every one, whatever his means or circumstances. The objects of pursuit are above, beneath, and around us; they are ever fresh and enticing; and we feel that we are as far from having exhausted their wonders to-day as we were twenty years ago.

"Not a plant, a leaf, a flower, but contains
A folio volume. We may read, and read,
And read again, and still find something new—
Something to please, something to instruct,
Even in the noisome weed."