PLANT MIND.

VII.

THE NERVES OF PLANTS.

The distinction or "boundary line" between plants and animals or between animal and plant life is not to be found; we are inclined to believe, does not exist. The arcana of life operation and life source have been explored in all their recesses, only with this measure of successful result, to prove that "all the boundless universe is life." In organization and function, in construction and requirements, plant life is not inferior to animal life; in delicacy, sensitiveness, and beauty only a part of the sublime unity and variety which express a Creator and a God throughout the visible works of His almighty hand. Variety of expression, in conjunction with fundamental principles of organic and mental life, seems to be the point at the base to which we are led, and from which we begin again when we attempt to read the "open secrets" of creative revelation which await our intelligent and loving recognizance.

Plant organization, reduced to its simplest form, is exhibited in the action of those threads, or internal *capillitium*, which, being spiral in their arrangement, conform to the fundamental law of harmony between structure and requirement, or fitness of contrivance, and by intuitive analogy, when microscopic investigation reveals the existence of channels for the conveyance of an ethereal fluid, expended in the acts of contraction and extension, in movements of approximation and fructification, in the care of offspring, evident sense of well-being or dejection; determined pursuit of light, air, and nutriment; submission and resistance—all these and more stimulate conjecture, and modern thinkers approach certainty, thus revolutionizing popular thought and every-day vision, until he "who had only eyes, now learns to see."

The presence of nerves in vegetable beings is from its very nature an obscure question, relating, as it does, pre-eminently to their internal structure, and some modern thinkers have even argued that their absence need not prove inanimation. This argument is advanced by M. Fechner, an eminent German naturalist. On the other hand, the Swedish botanist, Oken, saw nerves in the spiral fibers, and claimed the distinction of being the first botanist who admitted their purpose and office. Goethe held the same view; while our own American professor, Harlan Coultas, expands the idea of a ruling mind, operating upon and directing those subtle fluids and channels of communication, teaching most lucidly the roots, stems, leaves, buds, are parts of one individual, and each contains a link of connection with all its parts, as do muscles, bones, nerves, tissues, in the human frame. Indeed the nerves reach to the extremities of the whole vegetable body, and are the channels of communication with the sensorium, brain, or controlling force. The principle of unity is found to be complete, and, once fully recognized, we are easily led to believe it possible that even plant life may be capable of thought, adapted to the necessities and felicities of its plant individuality.

The first regular form seen by the unassisted vision, in the inner surface of the cell, is the spiral, and all subsequent additions assume this form, and can be resolved into it as their normal type. The *Trygnemas*, to be found in the pools and streams of India, and as high as 15,000 feet among the Himalayas, in the ice cold springs trickling from the edges of glaciers, are among the largest among the *Confervæ*, and have filaments as rigid and thick as horsehair. Under the microscope these filaments are seen to be joined by transverse tubes parallel to each other, and marked by articulations longer than broad. In their internal granular matter they exhibit the spiral arrangement, in some cases resembling repetitions of the Roman numeral X, and in others a series of the letter V; the spiral rings after conjugating producing a dark colored globule in one of the filaments.

Voluntary motion in one of its simplest forms is also exhibited in the class of *Confervæ* called Oscillatoriæ, which grow in masses of filaments based on a mucilaginous substance. Their filaments are elastic, simple, minute, and mathematically straight; distinguished by close parallel rings easily separating from each other. They oscillate to the right and left, and travel in a few hours to the distance of ten times their own length from the stratum. Many species have at their extremities a tuft of minute delicate *ciliæ* or hairs, which are constantly in motion. Three or four days constitute the average of their cycle of life. Dead filaments form the bases of living ones, and this peculiarity connects them with the coral zoöphytes, although there seems to be no necessity for supplying links between vegetable and animal life, but rather to recognize the simple universality of boundless life itself.

The functions of fructification and reproduction especially require a nervous apparatus of extreme delicacy and sensitive obedience to the controlling force of animation, and we find organisms in the hitherto much unexplored kingdoms of lichens, which bring abundant evidence in support of this statement. The cylindrical filaments which surround the cellules, and, we believe, invariably connected with them, form a beautiful network of meshes, and may be seen beautifully illustrated in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 126. In the approximation of filaments the sensations of need and supply are expressed and satisfied. Corresponding processes are thrown out, forming a transverse tube of communication, through which the endochrome of one can pass into the other, forming the round mass which becomes seeds or spores for reproduction of new beings.

The River Semania (*Semania fluviatilis*) has elastic, rigid, and bristly filaments, knotted at equal distances with swelling joints, springing from a cartilaginous disk, by which it is firmly held against the force and weight of strong currents and Alpine cascades. The sporules within the fronds break with great force through the tough knots at the joints, and Borg relates that these filaments have a movement of retraction which can be felt by the fingers which hold them.

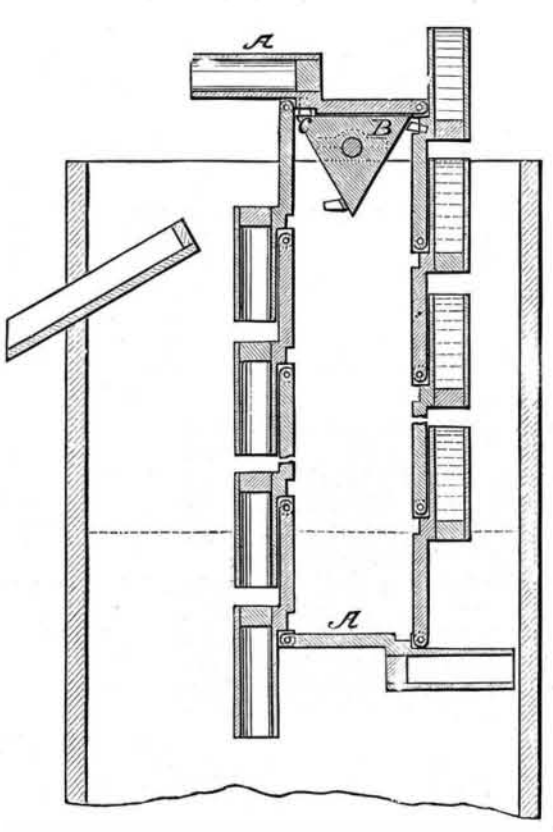
Confervæ are found in single branchless filaments, forming a loose, fleecy stratum, as well as aggregated together in singular forms. The filaments of the *Hydrodictyon utriculatum*, or water flannel, form a tubular purse or net, with regular polygonal meshes, sometimes slender as a horsehair and sometimes so coarse as to feel harsh to the touch. Each articulation gives birth to new filaments, which add new meshes to the net. It is of very common occurrence in ponds and ditches in the middle and south of England.

The researches of those who have sought the infinitely great in the infinitely little have discovered the existence of nervous filaments in even the fungi or embryonic or imperfectly developed organisms. Here are to be seen colored articulated filaments, forming a kind of fibrous crust, sprinkled over with loose granules, supposed to be the fructification. One curious species is found on windows and damp glass in shady places, and, if we mistake not, such a specimen is to be seen in one of the cases of our own New York Aquarium, having been found upon a pane of glass which came from Europe, and was permitted to remain undisturbed. The tendency to vegetate, therefore, would appear universally expressing itself in connection with cells and filaments, in the smallest and simplest organized object which performs the natural operation of multiplying itself; as well as in the larger and more complicated human form. Indeed, simplicity of organization reveals a wonderful persistency of vital principle, producing vast and dense masses, with an extraordinary rapidity of development, alike marvelous and beautiful. The only way to gain an insight into the mysteries of vegetable physiology is the close observation of the hitherto neglected department of botanical studies, the class of plants which are superficially supposed not entitled to even a place in the vegetable kingdom at all.

R. C. K.

A NOVEL CHAIN PUMP.

Mr. Theodore Wallis, of Scipio, N. Y., patented April 17, 1877, the improved chain pump herewith illustrated. Each link, A, is made with an offset, where is formed the lug by



WALLIS' CHAIN PUMP.

which the link is pivoted to the rear end of the next preceding link. The forward parts of the links are made cylindrical and hollow, to serve as buckets for raising the water. The endless chain passes around a triangular wheel, the sides of which are made of the same length as the rear part of the links. To the wheel, at the rear side of each angle, is attached a fork to guide the links into place, and to prevent them from slipping off said wheel. The forks, C, enter rabbets in the links, A, at their shoulders.

With this construction, as the hollow parts of the links, A, pass over the wheel, B, as the same is revolved, the water is discharged from them, and is received in the spout, by which it is conducted into a pail, trough, or other receiver.

The Coffee we Drink.

During the twenty years ending June 30, 1876, the United States imported over 2,200,000 tons of coffee, less than 100,000 tons of which were re-exported. During the year ending June 30, 1877, we imported 320,000,000 pounds of coffee, three fourths of which came from Brazil. For the twenty years mentioned our consumption of coffee averaged 200,000,000 pounds a year. During the last five years of the period it was 300,000,000 pounds. Latterly the relative amount brought from Brazil has declined, owing to the greater increase in the amount imported from other countries. Last year our coffee account with Brazil exceeded the sum of our exports thither by more than $28,000,000.

How to Make a Market for Iron and Steel.

More steel converters will not insure a greater consumption of their products. The need of railroads is only to bring and carry what is produced. The greater the production the greater the population and the greater the necessities of transportation. The greater the wear of rails the greater the demand for steel. The greater the employment in varied production, the greater the demand for implements, machinery, and tools. Now the great iron and steel industry of the United States can only have continual and insured prosperity by insuring a continued profit in the pursuits demanding steel. If there were a million more plows, or reapers, or axes, or looms, or turbine water wheels, or furnaces, or sugar refineries, or ships, or cars, or carriages, or a million of any or all the heavy things in which cheap and fine iron and cheap and fine steel are used, in request, how quick would the steel pulse of the nation feel the more rapid circulation! There is, then, an opportunity for a hint to the steel men in their efforts. A good manufacturer sees to it that he has a market. There is, he knows, no use in piling up even manufactured goods. For what, then, is there a demand? In what can idle capital and idle people be employed to provide renewed demand for iron and steel? If we turn to the statistics of commerce we shall find two facts: That the United States import a large amount of the products of other nations which can at the same time be as well produced at home, doubly rewarding the nation in keeping, employing, and earning what is now paid out. Second, that other nations import large amounts of goods, a great part of which the United States should be engaged in furnishing. Commercial regulations are necessary to enable these industries to assume equal positions; but, more than that, the knowledge of how these things are produced is most necessary, that our capitalists may invest safely, and also that our inventive people may furnish the labor saving appliances.

Among the things imported are $25,000,000 worth of flax products; and $75,000,000 worth of sugar. Where the sugar cannot be raised from cane it can profitably from beets. The flax is an industry indigenous to the country, and only needs the careful discrimination of the knowledge of how to produce to begin it.

Were the $100,000,000 saved among our people which has been paid out to foreign countries during the past ten years, our prosperity would be upon a better foundation. If we were sure that the country would have the employment and use of these two industries of $100,000,000 a year, there would be a far more animated blood passing through our veins than at the present. These two industries are by no means the only ones waiting assistance, but the fact remains that the more employment for labor and capital the more consumption of productions of all kinds.

American Street Cars.

There is perhaps no better illustration of the peculiar excellence of American workmanship than is furnished by the American horse car, nor any better proof of the good policy of superior workmanship than the favor with which these cars are received the world over. American cars are dearer than those made in Europe, yet ours are everywhere preferred, because of their superior lightness, strength, and durability. Wherever tramways exist there they may be found, testifying to the quality of the work of our well paid artisans. The proprietor of a shop which has sent cars to Europe, Asia, South America, and the isles of the sea, says that when the first dozen of American cars were placed on the road of the Bombay Tramway Company, the same number of English cars were introduced. Six months sufficed to prove the dearer American cars to be the most economical, and since then American cars have been used exclusively. The English car is one fourth heavier than the American, giving so much more useless dead weight to carry, and ultimately gives way at the joints.

Illustrated Advertising.

A correspondent of *Land and Water* sends to that paper specimens of illustrations of American agricultural machines and implements, and says that he does not wonder that such American manufactures find a ready market in all the British colonies, and sell in preference to English goods, seeing that such fine wood-cuts are sent out wherever the English language is spoken. The editor of the paper advises English manufacturers to profit by the example of their rivals, and improve their wood-cuts. Possibly, while they are about it, a corresponding improvement in the quality of their goods might also be found advisable.

Our Iron Trade.

After much converse with prominent iron manufacturers, a *Herald* correspondent is confident that, unless unforeseen disaster occurs, we shall soon take the lead of England in this line of manufacture. The present standing of the trade he sets down as follows: In the manufacture of pig iron we have driven England virtually out of our markets, except as to small quantities of Scotch pig iron; our merchant or bar iron is so good that we are able to export large quantities; in iron hardware we beat the world and control the foreign markets.