NOTICES OF BOOKS.

The Movements and Habits of Climbing Plants. By CHARLES DARWIN, F.R.S. Second Edition. London: Murray.

EVEN in the woodlands and hedge-rows of so-called temperate regions, climbing plants form a striking feature. Their graceful forms, the ease with which they are adapted to decorative purposes, and a certain weird character, which they seem to share with the serpent tribe, appeal at once to our æsthetic and imaginative faculties. But on a closer scrutiny we find that they afford at least an equal scope for the spirit of scientific inquiry. The first point which strikes even the cursory observer is the diversity of means by which the common object of deriving support from other plants or from inanimate substances is attained. We see plants with long flexible shoots which merely scramble over and through bushes, supporting themselves by their side-twigs, their leaves, or their prickles. Familiar instances of this may be found in brambles. These scramblers stand on the debateable land of climbing plants. If support is to be found they accept it in a rough way. But if not, they form independent bushes. Then we find root-climbers, of which the ivy may serve as an illustration. From its twigs it sends out broad, flattened roots, which attach themselves to every crevice and irregularity of the surface up which the ivy is climbing. Hence it is admirably adapted for covering the faces of rocks, walls, or the trunks of thick trees. Next come the true twiners, which twist spirally around any object which they are able to grasp, but are quite unfit to cling to a flat surface. The hop and the common bind-weed, as well as its garden congener the "morning glory," are types of this class. Lastly, we have plants which, like the vine and the pea, climb by means of special organs for laying hold of any suitable object. The next point which must have struck every observer even slightly versed in plant-lore is that climbers do not form or belong to any one botanical order or group of orders, but appear scattered through the whole vegetable kingdom.

Such, we may say, was the state of popular knowledge on the subject when Mr. Darwin entered upon the researches which form the matter of the work before us. He does not, however, profess to be the first scientific investigator of the phenomena presented by climbing plants. When his observations were more than half completed he learned that the "spontaneous revolutions of the stems and tendrils of climbing plants had been observed by Palm and Hugo von Mohl" as far back as 1827, and had been again investigated by Dutrochet in 1843. We may

here remark that the difficulty of finding whether a given subject has been already investigated is greater in Natural History than perhaps in any other branch of science. Important observations in zoology and botany may be found, not merely in the majority of scientific and literary periodicals, but even in sporting and political organs.

It must not, however, be supposed that Mr. Darwin's sole merit in this matter consists in verifying previous researches and in presenting them in a form accessible to the English reader. He tells us, with perfect justice :—" I believe that my observations, founded on the examination of above a hundred widely distinct living species, contain sufficient novelty to justify me in publishing them."

Twining plants form, it appears, the largest subdivision of the climbers, and represent, according to Mr. Darwin, the primordial and simplest condition of the class. If a young hop-shoot be observed as it rises from the ground, the first two or three joints are straight, and remain stationary, like the shoot of a non-climbing tree. The next joint, however, when still quite young, bends to one side, and moves slowly round to all points of the compass, travelling with the sun. In hot weather, if the plant is in vigorous health, each revolution is completed in two hours and about eight minutes. As the plant grows up the older joints lose this property, but the three top joints always continue to rotate. If the shoot is left free it describes a circle of about 19 inches in diameter. Another twiner, the *Ceropegia Gardnerii*, revolves in a direction opposite to the sun, and describes a circle of 62 inches in diameter. When one of these revolving shoots encounters a stick it twines round it in a spiral form. The thickness of the object found by a shoot is a very material point. The common nightshade (*Solanum dulcamara*) can twine only around such stems as are at once thin and flexible. The only native English twiner which can clasp trees is the honeysuckle, which Mr. Darwin has found twining up a young beech tree $4\frac{1}{2}$ inches in diameter. In a room lighted on one side *Phaseolus multiflorus* could not ascend posts of from 3 to 4 inches in diameter. In the open air it could twine round supports of this thickness, but failed ascending one of 9 inches. In South Brazil F. Müller saw a tree about 5 feet in circumference spirally ascended by a plant belonging to the Menispermaceæ. Mr. Darwin very aptly remarks that in cold climates it would be "injurious to the twining plants which die down every year if they were enabled to twine round trunks of trees, for they could not grow tall enough in a single season to reach the summit and gain the light." Twining plants with very long revolving shoots are not necessarily able to ascend thick supports, their great length and power of movement merely aiding them in finding a distant object up which to climb. The rate of revolution in all the plants observed by Mr. Darwin was merely the same by day as

by night, whence he infers that the action of the light is confined to retarding one semicircle and accelerating the other, not greatly modifying the speed of the whole revolution. It has actually been found that in *Ipomæa jucunda* the semi-circle from the light takes $5\frac{1}{2}$ hours, whilst the semi-circle towards the light is effected in 1 hour. In most twiners the branches, however numerous they may be, all go on revolving together. In *Tamus elephantipes* only the side branches twine and not the main stem. In a certain climbing asparagus the case was reversed. A plant of *Combretum argenteum* made a number of short, healthy shoots, which showed no signs of revolving, but at last it put out from the lower part of one of its main branches a thin sheet, 5 or 6 feet in length, which revolved vigorously and climbed. *Polygonum convulvulus*, according to Palm, twines only during the middle of the summer, but in autumn, even if growing vigorously, shows no tendency to climb. Three vegetable species,—two *Ceropegias* and *Ipomæa argyræoides*—in their dry home in South Africa grow erect and compact, but seedlings raised near Dublin, presumably in a conservatory, twined up sticks from 6 to 8 feet in height. On these significant facts Mr. Darwin thus comments:—"There can hardly be a doubt that in the drier provinces of South Africa these plants have propagated themselves for thousands of generations in an erect condition: and yet they have retained during this whole period the innate power of spontaneously revolving and twining whenever their shoots become elongated under proper conditions of life."

But we must now turn from the twiners to those plants which climb by means of prehensile organs, possessing a certain sensibility or irritability. The simplest and least developed of this class are the leaf climbers, which seize hold of any point of support either by the foot-stalks of their leaves, or by a prolongation of the midrib. Here, also, there is the power of revolving at various rates. But though no very sharp line of demarcation can be drawn between the twiners and the leaf-climbers, and some few of the latter "can ascend by twining spirally round a support;" yet the general object of the revolving motion is here to bring the foot-stalks or the prehensile tips of the leaves into contact with surrounding objects. The leaves are sensitive to a touch and to continued pressure even when very slight. Leaf-climbing may be easily understood by observing the species of *Clematis* and *Tropæolum*, including the common nasturtium. This plant, if it meets with a string or a thin twig, casts a hitch around it with one of its leaf-stalks, and thus secures a point of support.

More highly specialised are the plants which climb by the aid of tendrils, which Mr. Darwin defines as "filamentary organs, sensitive to contact, and used exclusively for climbing." These organs "are formed by the modification of leaves with their foot-stalks, of flower-peduncles, branches, and possibly stipules. In

this group, which includes the vine, the pea, and a number of Bignonias, the climbing organisation reaches its highest development. The twiner, in ascending a tree by its spiral folds, must, in order to reach the light above, describe a line very much longer than the perpendicular height to which it rises. Consequently it is compelled to expend a relatively large amount of matter. But the tendril-climber can ascend nearly in a straight line. The action of the tendrils is very curious. They revolve, and the shoot of the plant not unfrequently revolves also. If they touch any object they immediately begin to coil round it if thin enough, and become at the same time very much thicker and stronger. Tendrils which do not succeed in clasping anything generally wither and fall off. If the object found is too thick to be clasped, the points of the tendrils in some plants "exhibit a singular habit, which in an animal would be called an instinct." They continually search for any little chink or hole into which they may insert themselves. In other cases the ends of the tendrils are converted into flat discs, which are pressed close to the surface up which the plant is climbing. *Bignonia Tweedyana*, which Mr. Darwin has carefully studied, "combines four different methods of climbing generally characteristic of different plants, namely, twining, leaf-climbing, tendril-climbing, and root-climbing."

Among true root-climbers we fine a curious phenomenon—*Ficus repens*—a plant which creeps up a wall exactly like ivy, secretes from its rootlets an adhesive fluid, by which they are cemented to the wall or rock. This fluid was found to be slightly viscid, and on exposure to the air did not dry up. From experiments and observation made it would appear that the rootlets "first secrete a slightly viscid fluid, subsequently absorb the watery parts, and ultimately leave a cement." This appears to be a modified form of caoutchouc—a substance in which the genus *Ficus* is well known to abound.

A careful consideration of climbing plants can scarcely, in our opinion, fail to furnish evidence in favour of the doctrine of evolution. If we place any plant in the open ground, freely exposed to light and air from every side, we find it generally assume a compact, rounded habit; but if we set it where light and air are more or less cut off, as near lofty trees, among bushes, or in a thick wood, then two cases are possible. If the soil is poor, and if moisture is deficient, the plant will languish or even die; but if the earth be fruitful and moisture abundant, it will shoot out long, slender stems, seeking to win its way to the light. As gardeners and farmers often say, it will be "drawn" by the overtopping objects. Thus, then, the very circumstances which would render it necessary or desirable for a plant to climb, enable it, at any rate, to take the first step, by becoming more slender, longer in its joints, and more flexible.

If, as seems not unlikely, from several facts detailed in the work before us, there is a latent tendency to revolve in the shoots of all plants, this very attenuation and elongation will remove what was before a hindrance, and the power of twining may thus be gradually developed. Those forms which thus became climbers would in certain situations enjoy a great advantage over their rivals. We find further that the twining faculty appears in plants in many different grades. In some it is highly developed, in others dormant. There are cases where it appears to have been scarcely attained, and others in which it is becoming obsolete. From the twiner to the leaf and tendril-climbers the way is paved by small gradations. We cannot fail to recognise that the latter especially must have nearly the same advantage over twiners as these have in turn over plants unable to climb at all.

We cannot better conclude this brief and necessarily imperfect survey of a profoundly interesting subject than by quoting a portion of the final paragraphs of the work before us:—"When we reflect on the wide separation of these (climbing plants) in the series, and when we know that in some of the largest well-defined orders, such as the Compositæ, Rubiaceæ, Scrophuliariaceæ, &c., species in only two or three genera have the power of climbing, the conclusion is forced on our minds that the capacity for revolving, on which most climbers depend, is inherent, though undeveloped in almost every plant in the vegetable kingdom.

It has often been vaguely asserted that plants are distinguished from animals by not having the power of movement. It should rather be said that plants acquire and display this power only when it is of some advantage to them; this being of comparatively rare occurrence as they are fixed to the ground, and food is brought to them by the air and rain."

A Course of Practical Instruction in Elementary Biology. By T. H. Huxley, LL.D., Sec. R.S., assisted by H. N. Martin, D.Sc. London: Macmillan and Co.

This work is arranged upon a somewhat novel plan. The author describes in succession yeast, protococcus, the proteus animalcule, bacteria, moulds, stone-worts, the bracken-fern, the bean-plant, the bell-animalcule, the fresh-water polypes, the fresh-water mussel, the fresh-water crayfish and the lobster, and, lastly, the frog. After the description follows in each case a section headed Laboratory Work, and containing instructions for the practical examination of the plant or animal in question. By way of a specimen of the task thus set the student, we insert an abridgment of the "Laboratory Work" on the *Amœba*:—"Place a drop of water containing *Amœbæ* on a slide, cover with a cover-glass, avoiding pressure, and search over with a