fellow for a son-in-law. But it would go hard with me if I had to let youngsters of his species get on my knee and pull my face down by the whiskers to kiss me." The ballet music in the third part is full of Italian concetti, and still has a Parisian ring. It is very pretty, lively, meretricious, and could be easily adapted to musical boxes and hurdy-gurdies.

Labiche was received to-day at the Academy by John Lemoinne, the intellectual hornet of the *Débats*, who, without malice prepense, is ever ready to inflict a superficial sting on no matter what party leader or passing idol. He is not Jack the Giant Killer, but John the Giant Stinger. The pain caused is never excruciating, but it is tormenting; and when the victim thinks he has got over the annoyance, he finds he is not yet done with it. John Lemoinne's sharp sayings, which have generally the merit of being witty, get at once into drawing-room circulation, and run from one journal to another, until all the whole town has got hold of them. John Lemoinne is a Parisian of Jersey origin. Labiche is a Boulevardier of the Sologne, where he lives all the year round, unless when his Palais Royal plays bring him to town. He manages a large estate, which he has improved up from a valueless *lande* to a model farm. Chambord is not far from his manor, near which there is a model village, of which Labiche is manager and patriarch. The only books he reads are treatises on farming and gardening. His plays, which brim over with fun, are written in the long evenings. The chief butt for his mirth is the bourgeois of Paris. Labiche does not set up to castigate human nature. It amuses him, and he thinks clever people would lead a dull life if there were not fools and dunces in the world. There is nothing biting in his wit. If he shows his teeth it is to enjoy a hearty laugh.

## *MR. DARWIN ON THE MOVEMENTS OF PLANTS.**

"STONES grow, plants grow and live, animals grow, live, and move," is an old definition of the three kingdoms of nature. Like most epigrams it is only half true. We have known for a long time that some plants are anything but motionless, and that some (among the duckweeds, for example) are even locomotive. Most people, without being professed botanists, have heard of the sensitive plant that folds its leaflets when stirred by a rough touch, and of the aspen that quivers incessantly even when the wind is still. Wordsworth has sung of the lesser celandine that shrinks from cold and rain "muffled up from harm in close self-shelter," and of the budding twigs that "spread out their fan to catch the breezy air." A lesser poet reminds us of the sunflower that "turns to her god when he sets the same look which she turned when he rose;" and a like fact is crystallized in the common name of the Jerusalem artichoke, for "Jerusalem" is a corruption of "girasol." The sleep of plants, too, is familiar matter to the poets: from Heine, whose "lonely pine-tree" slumbered and dreamed, to Tennyson, whose "pimpernel dozed on the lea." Linnæus, who died a worn-out old man at the very age when Mr. Darwin, fresh and vigorous, is still attacking and solving new problems in life-science, was the first to give an accurate account of this curious night-side of plant-nature. In his "Somnus Plantarum" he tells us that he sowed some lotus seeds and watched them till at last two blossoms appeared. At evening he looked for them again, but they were gone; he thought they had been plucked. Next morning, however, they reappeared, and on watching them with care he found that at night the lotus leaves had curled over the flowers and hid them from sight. He straightway took a lamp, and going out to his familiar garden-beds found that the look of all the well-known flowers was changed: he had discovered the sleep of plants. Heine must have overlooked this little story when he wrote the exquisite "Lotosblume."

The scattered facts of plant-motion have long engaged Mr. Darwin's attention: their significance to the great theory which links all living things together in the bond of kinship and descent is obvious at once. It has remained for the veteran naturalist to show that these motions are universal and that they are ceaseless, to prove how various, how useful, and how ordered they really are. More than that, he gives us the clue to their evolution, and once more exhibits the fertility and the fitness of the hypothesis which we always associate with his name. In the work on "Climbing Plants" the large and obvious movements of runners and tendrils and the purposes they serve were described and discussed. In the "Carnivorous Plants" the minuter but not less wonderful movements of special gland-hairs and cell-contents caused by the contact of a special food were first made known to us. In the present volume are treated "large classes of movement common to almost all plants." The record of the many thousands of careful experiments and observations made by the author and his sons impresses us with the untiring zeal for utter truth, the unresting search after the thing as it really is, which have always been the notes of his work. Facts, and in abundance; experiments, varied and tested and confirmed till they are beyond cavil—these are the basis of all Mr. Darwin's contributions to science; the superstructure of speculation and hypothesis is never raised till the foundations are firm and unassailable. It is this combination of the power of discovering and collecting the multitudinous facts of nature, and the very different power of breathing into these facts the vivifying breath without which they would be but formless and void, that has made his name stand first among biologists.

In the present work a modification of the graphic method so well applied by Marey and others to the study of animal movement has been used to investigate the movements of vegetable organs. The rhythm of the pulse or of the complex paces of the horse can be made to record itself by permanent markings on a moving surface. The direct study of such rapid movements would be extremely difficult: the study of the traces they leave can be pursued at leisure and is only a matter of decipherment. Mr. Darwin caused the rootlets of growing seeds, the tips of leaves, &c., to press lightly on smoked glass, and so leave evidence of their motions. Or, fastening a delicate filament tipped with wax to the moving organ, he plotted down on a fixed surface placed beside it the successive positions of the wax at short intervals of time. The diagrams thus obtained, of which a large number are reproduced, are wonders of variety and complexity. Applied to almost all orders of plants, the method shows that every stem, every leaf, every root is in a state of incessant writhing and wriggling motion called here "circumnutation."

In this universally present movement we have the basis or groundwork for the acquirement according to the requirements of the plant of the most diversified movements. Thus the great sweeps made by the stems of twining plants, and by the tendrils of other climbers, result from a mere increase in the amplitude of the ordinary movement of circumnutation. The position which young leaves and other organs ultimately assume is acquired by the circumnutating movement being increased in some one direction. The leaves of various plants are said to sleep at night, and it will be seen that their blades then assume a vertical position through modified circumnutation in order to protect their upper surfaces from being chilled through radiation. The movements of various organs to or from the light, so general throughout the vegetable kingdom, are all modified forms of circumnutation; as again are the equally prevalent movements of stems, &c., towards the zenith and of roots towards the centre of the earth. There is always movement in progress, and its amplitude, or direction, or both have only to be modified for the good of the plant in relation with internal or external stimuli. (P. 3.)

The fact of the movement made out, we are led to ask what mechanism produces it. Among the higher animals movement implies for the most part contraction of muscular tissue—*i.e.* change in the cell-elements of a certain structure unaccompanied by growth. But the vastly slower movements of the end of a nail or of a hair are due to growth alone without cell-change analogous to the first. The movements of vegetable organs have like causes. While the plant is still young, a development of tissue on one side more than on the other will cause a movement towards the less-growing side. The rapid growth of young plants makes this movement very perceptible. When the plant is full-grown its power of motion tends to be localized in certain joints or *pulvini*. The cells of these organs are in an unstable and variable state. Closely observed, they are seen to swell out now at one part, now at another; and this partial and successive turgescence is followed of course by successive nutations of the plant in various directions. The swollen cells shrink again without undergoing multiplication or increase; and we have thus a case of movement produced by mere transitory cell-change not followed by growth. The surface differences between the motor mechanisms of plants and animals are hardly less interesting than the fundamental analogies; but we cannot stay to discuss them. It will suggest reflection merely to point out that when an aminal bends a limb it contracts the tissue on the concave aspect; when a plant moves its stem it is the tissue on the convex aspect which expands.

As plants afford instances of movement without muscle, so also they seem to show that they can transmit from part to part something that is akin to nervous influence without possessing nerves. In what is practically a distinct investigation, Mr. Darwin describes the wonderful powers that reside in the tip of a growing rootlet. The experiments made to bring these powers to light are characterized by all the ingenuity and perseverance that we have recognized in the first part. We are in doubt which to admire most, the astonishing endowments of the tiny radicle or the unfailing skill and fertility of resource displayed in discovering them. We cannot do better than state the results in the author's own words:—

If the tip of the radicle be lightly pressed, or burnt, or cut, it transmits an influence to the upper adjoining part, causing it to bend away from the affected side; and what is more surprising, the tip can distinguish between a slightly harder and softer object by which it is simultaneously pressed on opposite sides. If the tip perceives the air to be moister on one side than on the other, it likewise transmits an influence to the upper adjoining part, which bends towards the source of moisture. When the tip is excited by light the adjoining part bends from the light; but when excited by gravitation the same part bends towards the centre of gravity. In almost every case we can clearly perceive the final purpose or advantage of the several movements. The course pursued by the radicle in penetrating the ground must be determined by the tip, hence it has acquired such diverse kinds of sensitiveness. It is hardly too much to say that the tip of the radicle thus endowed, and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals; the brain being seated within the anterior end of the body, receiving impressions from the sense organs, and directing the several movements. (P. 572).

Sir James Paget recently delivered an admirable address at Cambridge, in which he counselled human pathologists to study the diseases of plants. There, said he, you will be able to study elemental pathology, the pathology of cells and tissues, freed from the complexity of a circulating blood and a nervous system. These obscure the morbid processes that take place in man by bringing into connection the healthy parts and the diseased. In a diseased or injured plant you can examine and observe the diseased part in and by itself. We are not rash in predicting that after this work of Mr. Darwin's the students of animal physiology will be led to seek light on the essential nature of muscle and nerve, on healthy function as well as morbid, by investigating the motor and sensory properties of plants. On all sides botany is advancing to a position not less important than that occupied by her more favoured sister zoology, and her contributions to knowledge are every day becoming more and more essential to that complete biology, that science of all living things, which embraces them both.

* "The Power of Movement in Plants." By Charles Darwin, LL.D., F.R.S., assisted by Francis Darwin. (London: John Murray. 1880.)

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