

THE TIMES, SATURDAY,

NOVEMBER 20, 1880.

Of all our living men of science none have laboured longer and to more splendid purpose than MR. DARWIN. It is more than forty years since the publication of the "Narrative of the Voyage of the Beagle" placed him in the first rank of naturalists. Since that event he has produced work after work, each of them truly "epoch-making," and marked at once by unique originality, endless ingenuity in experimenting, and matchless industry. His monographs, remarkable though they are, will not form his only monument; his name is identified with a theory which it is confidently predicted by many scientific men will be spoken of in after ages as NEWTON'S theory of gravitation or KEPLER'S laws are now mentioned. At the age of seventy-one MR. DARWIN has just produced another work, which is not less interesting and curious than its predecessors, and which, it cannot be doubted, is destined to mark an æra in biological science. The drift of much of his recent labours has been to break down the sharp divisions supposed to exist between the animal and vegetable kingdoms. Plants and animals are, in his pages, brought under the operation of the same great laws. Most of the fancied peculiarities of the latter are shown to be shared by the former. Plants move; they are sensitive; they have appetites; they are carnivorous. We learn from his new book how they sleep, how certain leaves, like beasts of prey, rise in the evening and sink in the morning, and how there are plants which take pains to avoid intense light. He demonstrates that plants and animals have acquired habits of moving at stated periods, and that many of the actions of the former closely resemble the unconscious movements of the latter. The tips of the radicles of plants are so sensitive, their influence on all adjoining parts is so great, that, MR. DARWIN tells us, they act like the brains of the lower animals. What strange revelations of functions may we not expect as these investigations proceed, when we learn that the momentary touch of a piece of raw beef will cause a leaf of a carnivorous plant which had been motionless for hours to curve? "The Loves of the Plants," as magniloquently sung by MR. DARWIN'S grandfather, do not seem so fabulous and fanciful after all, when the latent and subtle capacities of the vegetable world are disclosed by the grandson. In short, MR. DARWIN has shown, to the discomfiture of old notions, that unity reigns where it was imagined there were diversity and confusion. His latest book, "The Movements of Plants," just published by MR. MURRAY, continues the investigations described in "Movements and Habits of Climbing Plants," and helps to complete the revolution which MR. DARWIN has for years been working in the domain of botany.

Every one knows that some plants can move. The eccentric movements of the stems of climbing plants are noticeable to any eye. The fact that the position of the leaves of some plants is affected by light is also readily observable; and the influence of gravitation on their growth has been always taken for granted. Some botanists and physiologists, such as SACHS, DE VRIES, PFEFFER, and others, have studied this obscure part of plant life with more or less closeness. But it has been left to MR. DARWIN, assisted by MR. FRANCIS DARWIN, to so extend his observations and experiments as for the first time to give a connected view of the matter. His methods of observation are curious and ingenious; they are similar to those which chemists and physicists have employed, but which it was left for MR. DARWIN to prove could be applied with signal success to plants. Sometimes the subjects on which he experimented were protected from the light; at other times the light was admitted from one side, or from above. A glass filament of inappreciable weight was delicately attached to a part of the plant to be observed, and a minute bead was cemented thereto. The movements of the latter relatively to a black dot on a bit of card placed at hand were magnified and faithfully recorded. In this way and in others MR. DARWIN was able to note the smallest motions of the radicles of seeds, or flower stems. One interesting class of observations was directed to the so-called sleep of plants,—a phenomenon noted so long ago as the time of PLINY and described by LINNÆUS in his "*Somnus Plantarum*," and the subject of many modern monographs, but never so clearly analyzed and explained as it is by MR. DARWIN. His plan of observation was to keep the plants awake, or, speaking less figuratively, he tied down the leaves of plants subject to periodical movements to prevent them from assuming their normal vertical position at night. Curious and decisive results were obtained from these experiments, conducted apparently with unique care: the leaves pinned out horizontally were frost-bitten in a temperature which was not injurious to the free leaves which were allowed to go to sleep. In short, it was demonstrated that the natural vertical positions of the leaves protected them in some degree from the effects of radiation and cold, and the working of a beautiful law, which is, as MR. DARWIN says, "a question of life and death" in the economy of the plant, was revealed with new precision. Study of the movements by night of plants, pursued in this thorough fashion, tended to show the operation of simple and all-pervading principles. For instance, one kind of plants, the leaves of which stand almost horizontally during the day and hang down vertically at night, did not observe the ordinary law when kept in a hall lighted only from the roof; the sufficient explanation was that plants do not sleep at night unless they are bathed in light during the day. MR. DARWIN'S observations were continued through the twenty-four hours, and they revealed the fact that there is no rest for the sleeping plants, but that day and night the leaves are in motion. The well-known sensitiveness of certain plants to light has also been examined and illustrated by MR. DARWIN in a new and striking manner, and by means of experiments of much ingenuity. The exquisite machinery of the human eye is the subject of admiration; but he has found that vegetable organizations, such as the seedlings of the *Phalaris canariensis*, can detect differences in light which are not appreciable by that organ. They will follow sympathetically the smallest point of light. When MR. DARWIN capped young cotyledons with glass tubes unpainted, they showed their sensitiveness to light, while those from which light was excluded, by means of opaque caps, remained vertical. MR. DARWIN'S rich and varied observations have proved that light acts on plants, especially certain parts of them, in much the same way as it does on the nervous system of animals, and that it is an agency of unsuspected importance in the economy of the former.

To most minds these researches will open new vistas and give fresh significance to common things. No plant, no part or organ of it, we see, is at rest; all is in motion, and in motion in the same manner; even before the seedling has broken through the ground this universal "circumnutation movement," this growth of cells, first on one side, then on another, begins. Gravitation affects this movement; so does light, guiding the seed upwards, it may be, through a crack in the ground or a mass of overlying vegetation. But always this circumnutation or revolving movement in each shoot, petiole, and leaflet goes on, and "if we could look beneath the ground, and our eyes had the power of a microscope, we should see the tip of each rootlet endeavouring to sweep small ellipses or circles, as far as the pressure of the surrounding earth permitted. All this astonishing amount of movement has been going on from year to year since the time when, as a seedling, the tree first emerged from the ground." A beautiful unity is thus recognized as prevailing in the growth of all plants and all their parts. The sweeps made by the stems and tendrils of climbing plants, the movements of leaves at night, or the advances of the organs of plants towards the light, are but modifications of the movements observed by the buried seeds. Science has told in modern times many strange tales, and has deciphered similarity in things far apart. It has found likeness between the properties of the stinging nettle and the muscle of the highest organized animals. It professes to have discovered a common substance as the basis of all forms of life. But it has not revealed for many a day more novel prospects, more surprising unities, than those which MR. DARWIN discloses or explains in his latest work.

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Of all our living men of science none have laboured longer and to more splendid purpose than Mr. Darwin. It is more than forty years since the publication of his "Narrative of the Voyage of the *Beagle*" placed him in the first rank of naturalists. Since that event he has professed work after work, each of them truly "epoch-making," and marked at once by unique originality, and by eminence in experimenting, and methodical industry. His monographs, remarkable though they are, will not form his only movements; his name is identified with a theory which his confidently professed by many scientific men will be spoken of after ages as Newton's theory of gravitation or Kant's laws are now mentioned. At the age of seventy-two Mr. Darwin has just produced another work, which is not less interesting and curious than his predecessors, and which, it cannot be doubted, is destined to mark an era in biological science. The drift of much of his recent labours has been to break down the sharp divisions supposed to exist between the animal and vegetable kingdoms. Plants and animals are, in his paper, brought under the operation of the same great laws. Most of the fancied peculiarities of the latter are shown to be shared by the former. Plants move; they are sensitive; they have appetites; they are carnivorous. We learn from his own book how they sleep, how certain leaves, like those of prey, rise in the evening and sink in the morning, and how there are plants which take pains to avoid intense light. He demonstrates that plants and animals have acquired habits of action at stated periods, and that many of the actions of the former closely resemble the unconscious movements of the latter. The tips of the radicles of plants are so sensitive, their influence on all adjoining parts is so great, that, Mr. Darwin tells us, they act like the brains of the lower animals. What strange revelations of functions may we not expect to these investigations proceed, when we learn that the secretory touch of a piece of raw beef will cause a leaf of a carnivorous plant which had been motionless for hours to curve! "The Loves of the Plants," so magnificently sung by Mr. Darwin's grandfather, do not seem so fanciful and fanciful after all, when the latent and subtle capacities of the vegetable world are disclosed by the grandson. In short, Mr. Darwin has shown, to the discomfiture of old notions, that unity reigns where it was imagined there were diversity and confusion. His latest book, "The Movements of Plants," first published by Mr. Murray, contains the investigations described in "Movements and Habits of Climbing Plants," and helps to complete the revolution which Mr. Darwin has for years been working in the domain of botany.

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To most minds these revelations will open new vistas and give fresh impetus to botanical thought. No plant, no part of organs of it, we can, as it were, be in motion, and in motion by the same means; even before the seedling has broken through the ground this universal "circumlocutionary movement," this growth of cells, first on one side, then on another, begins. Germination affects this movement; as does light, guiding the seed upwards, it may be, through a crack in the ground or a mass of overlying vegetation. But always this circumlocutionary or circling movement is each short, partial, and leaflet grows on, and "if we could look beneath the ground, and our eyes had the power of a microscope, we should see the tip of each needle undulating to sweep small ellipses or circles, as far as the fragments of the surrounding earth permitted. All this undulating amount of movement has been going on from year to year since the time when, as a seedling, the first tree 'emerged from the ground.' A beautiful way to view germination as germinating in the growth of all plants and all their parts. The sweeps made by the stems and tendrils of climbing plants, the movements of leaves at night, or the advances of the organs of plants towards the light, are but modifications of the movements observed by the buried seeds. Science has told in modern times many strange tales, and has distinguished similarity in things far apart. It has found likeness between the properties of the floating nuclei and the atoms of the lightest organized animals. It professes to have discovered a common mechanism at the basis of all forms of life. But it has not revealed, for many a day more novel prospects, more surprising unities, than those which Mr. Darwin discloses or explains in his latest work.