

A new volume by Mr. Darwin, assisted by his son, Francis Darwin, on the power of movement in plants, is an interesting botanical research, such as would probably, in the case of any other writer, have been issued in the Transactions of one of the learned societies. It is well known that many plants exhibit a rotary movement, which Mr. Darwin terms circumnutation, and to this phenomenon and its varieties the volume is devoted. These movements describe generally irregular circles, which have their longer axes directed successively to different points of the compass. While describing these figures the apex of the plant often travels in a zigzag line. This movement is a consequence of an inflated condition of the cells, which causes a bending of the plant, which is usually accompanied by growth. In many plants there is a sudden jerk forward from a length of a two-thousandth to a thousandth of an inch. The part then slowly retreats to a portion of this distance, because the tissues are elastic, but soon jerks forward again. The elongation of the cells takes place under the influence of light. The roots of a plant also descend down into the earth in a spiral direction under the influence of gravity. The growing root of a seedling bean can displace a weight of some pounds. The power of movement in the root enables it to penetrate the earth in the direction of least resistance. The roots are deflected towards moisture, and generally bend away from light. After the radicle is developed the stem or epicotyl breaks out. Many of the organs of plants are arched even before they break through the ground, and at the same time the circumnutation aids the organs in bursting through the ground. In many seedlings the upper part of the radicle contracts so as to drag the cotyledons down into the ground, and this burping process is believed to protect the young plants against the frosts of winter. In an acacia tree every leaflet, sub-petiole, and petiole is constantly describing small ellipses. The leaves generally move up and down, the lower petioles circumnutate, and this movement has continued since the time when the tree first commenced to grow. Climbing plants at first circumnutate like other plants, but after a

time the movement increases in amount and extends more equally in every direction round the plant. The sleep of leaves, which results from the influence of light and darkness, is another illustration of circumnulating movements. In some plants the leaves sleep, but the cotyledons do not. In other plants the reverse condition obtains, and in some others both sleep at night. These movements protect the leaves, since they suffer less from cold at night than when compelled to remain horizontal. The movements of leaves are, however, somewhat dependent on moisture, for Mr. Darwin mentions the case of a *perforata* which remained closed all day, as if asleep, when the plant was dry, as though endeavoring to check evaporation. Light coming in a lateral direction causes the plant then circumnutate to bend towards the light, but too much light is capable of injuring the leaves of some plants, and they twist so as to prevent their edges to the sun. Finally, Mr. Darwin compares these movements of plants to the unconscious movements of the lower animals. A very small stimulus produces an effect. The most sensitive part of the plant is the tip of the radicle, which transmits the influence it experiences to the other parts of the organism. The bulk of the volume is occupied with the description of the movements of numerous plants, and these movements are illustrated by a large number of diagrams. The work is a remarkable contribution to knowledge, but it may be doubted whether the importance of these movements is great in bringing about the evolution of other plant form or organization.

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