

# The Pharmaceutical Journal.

SATURDAY, APRIL 29, 1882.

Communications for the Editorial department of this Journal, books for review, etc., should be addressed to the EDITOR, 17, Bloomsbury Square.

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## DARWIN'S BOTANICAL WORK.

MR. DARWIN'S work was so many-sided, his researches touching on almost every branch of natural history, that even to enumerate their results would occupy more space than we have at our command. We propose, therefore, to confine ourselves to a brief *résumé* of his chief contributions to botanical science, taking up his more important works nearly in the order of their publication.

The 'Origin of Species by means of Natural Selection' (1859) deals more largely with the laws of the animal than of the vegetable kingdom; though MR. DARWIN supports his well-known conclusions as to the influence of natural selection in bringing about the evolution of species, by such familiar facts as the uncertainty of the characters by which species are distinguished in many genera of plants, the alteration in fruits and flowers that results from artificial selection, and the faculty possessed by some species of altering their habit or external characteristics to adapt themselves to changed conditions.

In his 'Variation of Animals and Plants under Domestication' (1868), these subjects are followed out in detail, with great wealth of illustration. The great variation is pointed out which exists in our cultivated cereals, culinary plants, fruit trees, ornamental trees, and garden flowers, and the difficulty, in many cases, of referring their ancestry to any existing wild species. The laws of inheritance are discussed and illustrated, and are thus summarized:—

"Firstly, a tendency in every character, new and old, to be transmitted, by seminal and bud generation, though often counteracted by various known and unknown causes. Secondly, reversion or atavism, which depends on transmission and development being distinct powers; it acts in various degrees and manners through both seminal and bud generation. Thirdly, prepotency of transmission, which may be confined to one sex, or be common to both sexes of the prepotent form. Fourthly, transmission limited by sex, generally to the same sex in which the inherited character first appeared. Fifthly, inheritance at corresponding periods of life, with some tendency to the earlier development of the inherited character."

The subjects of crossing and interbreeding, to

which MR. DARWIN subsequently paid so much attention, are here first entered on in detail; the general conclusion arrived at being that the crossing of animals or plants which are not closely related to each other is highly beneficial or even necessary, and that interbreeding prolonged through many generations is highly injurious. Several chapters are occupied with an account of the laws of variation and the intricate and difficult subject of the correlation of different organs.

In 1862, DARWIN had published 'The Various Contrivances by which Orchids are fertilized by Insects,' the first of the works in which he deals specially with the part played by insects in the fertilization of flowers. The plants belonging to this interesting and beautiful order are shown to be, with a few striking exceptions, like that of our wild bee-orchis, cross-fertilized, to the complete exclusion of self-fertilization, the pollen being in some cases absolutely poisonous to the stigma of the same flower. With reference to the contrivances to this end, MR. DARWIN remarks that the more he studies Nature "the more he becomes impressed, with ever-increasing force, that the contrivances and beautiful adaptations slowly acquired through each part occasionally varying in a slight degree but in many ways, with the preservation of those variations which were beneficial to the organism under complex and ever-varying conditions of life, transcend in an incomparable manner the contrivances and adaptations which the most fertile imagination of man could invent." The orchid family are, however, remarkable in all parts of the globe for their sterility; but when they do produce seeds their fertility is amazing. MR. DARWIN calculates that the offspring of a single plant of *Orchis maculata* might, in three generations, nearly clothe the land throughout the globe. This volume closes with the famous aphorism, "It is hardly an exaggeration to say that Nature tells us, in the most emphatic manner, that she abhors perpetual self-fertilization."

In his 'Insectivorous Plants' (1875), DARWIN touched on fresh and almost untilled ground. It will be needless to give any description of the general scope of this remarkable work; some of the results recorded in it were startling even to experienced botanists. Among the most interesting was the evidence afforded of the extraordinary sensitiveness of the organs of these plants to the most delicate external impressions. Two particles of the thinner end of a woman's hair, one of these being  $\frac{1}{1000}$  of an inch in length and weighing  $\frac{1}{1000000}$  of a grain, the other,  $\frac{1}{1000}$  of an inch in length, were placed on two glands on opposite sides of the same leaf of *Drosera rotundifolia*, and these two tentacles were inflected half way towards the centre in an hour and ten minutes, all the many other tentacles round the same leaf remaining

motionless. Again, a minute drop, about equal to  $\frac{1}{10}$  of a minim, of a solution of 1 part of phosphate of ammonia to 875 of water, was applied to the secretion on these glands, each of which thus received only  $\frac{1}{875}$  of a grain or .00112 mg.; and all three tentacles became inflected. But the most important result of these investigations was undoubtedly the proof that in certain circumstances plants may perform a process of digestion, strictly resembling that which ordinarily takes place in the animal kingdom. All the plants belonging to the six genera of *Droseraceae*, and several others, have the power of dissolving animal matter by the aid of their secretion, which contains an acid, together with a ferment almost identical in nature with pepsin; and they afterwards absorb the matter thus digested.

'The Movements and Habits of Climbing Plants' (1875) is an extension of a paper contributed to the Linnean Society in 1865. In this work Mr. DARWIN first called attention to these remarkable movements of plants, to which a later volume is devoted, and which he compares to the movements of the tentacula of a polypus. The object of tendrils, twining stems, etc., is to enable the plant, by climbing, to reach the light and free air with as little expenditure of organic matter as possible; and the means by which the various movements are effected is probably unequal growth.

In 'The Effects of Cross and Self-Fertilization in the Vegetable Kingdom' (1876), DARWIN has collected the results of a very large number of experiments performed by himself with unwearied industry. The general result is that cross-fertilization has a tendency to cause the production of a larger number of seeds, and that these seeds will give rise to larger and more vigorous plants, than self-fertilization. This, however, is not the result of any inherent dislike of Nature to a union between near relatives; the advantage obtained by crossing "depends on the individuals which are crossed differing slightly in constitution, owing to their progenitors having been subjected during several generations to slightly different conditions, or to what we call in our ignorance spontaneous variation. This conclusion," Mr. DARWIN says, "is closely connected with various important physiological problems, such as the benefit derived from slight changes in the conditions of life, and thus stands in the closest connection with life itself. It throws light on the origin of the two sexes, and on their separation or union in the same individual, and lastly on the whole subject of hybridism."

'The Different Forms of Flowers on Plants of the same Species' (1877) treats chiefly of heterostyled (or dimorphic) species, like the primrose, which have two or more kinds of flowers with styles of different lengths, and of cleistogamic flowers, or those entirely destitute of petals, like the closed flowers of the violet, which are necessarily self-fertilized. Cleisto-

gamic flowers he regards as modified and degraded for the purpose of affording an abundant supply of seeds with but little expenditure; perfect flowers being still almost always produced so as to allow of occasional cross-fertilization. Unisexual (monoecious, dioecious, or polygamous) flowers, DARWIN also believes to have been degraded from the hermaphrodite condition. The sole motive which he can suggest for the separation of the sexes is that the production of a great number of seeds might become superfluous to a plant under changed conditions of life; and that it might then be highly beneficial to it that the same flower or the same individual should not have its vital powers taxed, under the struggle for life to which all organisms are subjected, by producing both pollen and seeds.

'The Power of Movement in Plants' (1880) is an extension of the subject of which Mr. DARWIN had already treated in his 'Climbing Plants'; and the results are fully confirmatory of the view there expressed, that the power of apparently spontaneous movement is no criterion by which animal can be distinguished from vegetable life. The author is led, in fact, to the surprising conclusion that the power of slow rotatory motion, with which botanists were already familiar in the case of tendrils and twining stems, and to which he now gives the name "circumnutation," is invariably possessed by every growing part of every plant, though often on a small scale. Even the stems of seedlings, before they have broken through the ground, as well as their buried radicles, circumnutate, as far as the pressure of the surrounding earth permits. "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." It is, in fact, the source of those movements, so important to the subsequent life of the plant, of epinasty and hyponasty (or the power of bending downwards or upwards), circumnutation, the sleep-movements of leaves, heliotropism, and geotropism.

We should add that on March 16, within little more than a month of his death, two papers by Mr. DARWIN were read at the Linnean Society, on 'The Action of Carbonate of Ammonia on the Roots of certain Plants,' and on 'The Action of Carbonate of Ammonia on Chlorophyll Bodies.' These papers were an extension of previous observations, in his 'Insectivorous Plants,' on the phenomenon known as aggregation of protoplasm, and exhibited no deterioration of that patience in collecting facts, closeness of observation and cautious reasoning, which have so eminently marked the whole of Mr. DARWIN's scientific career, and which every young inquirer into science should hold before him as models for his own guidance.

#### BOTANICAL LECTURES AND DEMONSTRATIONS AT THE GARDENS OF THE ROYAL BOTANIC SOCIETY.

It will be noticed by reference to the advertisement of the School of Pharmacy of the Pharmaceutical Society of Great Britain, that Professor BENTLEY will commence his Lectures and Demonstrations on Systematic and Practical Botany, at the Gardens of the Royal Botanic Society, in Regent's Park, on Saturday morning next, May 6, at 8 o'clock. The Lectures will be continued on the successive Friday and Saturday mornings at the same hour till the end of July.