

palæontology of any formation that we possess, and with the previous volumes of Professors Leidy, Cope, and Lesquereux it will materially assist in solving one of the most difficult problems in the Geology of Western North America, involving the relations of the lignitiferous deposits to the well-marked cretaceous rocks underlying them.

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### FERTILIZATION OF PLANTS.\*

IT is probably well known to most of our readers that Mr. Darwin many years ago was led to the belief that cross-fertilization was a necessary process in many, perhaps in most plants, even though the organs of the two sexes might be present together in their flowers. The prime agents in effecting this he took to be insects, and his own researches on the Orchids, the Primulaceæ, and some other groups of plants, followed by the investigations of other naturalists, both in this country and abroad, have gone far towards establishing the truth of this generalization. The means by which the cross-fertilization of plants, by the contact of the pollen of one flower with the stigma of another flower, on the same or a different plant, is provided for, are indicated as follows by Mr. Darwin in his lately published book on "The Effects of Cross and Self-Fertilization." He says: "Cross-fertilization is sometimes ensured by the sexes being separated, and in a large number of cases by the pollen and stigma of the same flower being matured at different times. Such plants are called dichogamous, and have been divided into two sub-classes: proterandrous species, in which the pollen is mature before the stigma, and proterogynous species, in which the reverse occurs; this latter form of dichogamy not being nearly so common as the other. Cross-fertilization is also ensured, in many cases, by mechanical contrivances of wonderful beauty, preventing the impregnation of the flowers by their own pollen. There is a small class of plants, which I have called dimorphic or trimorphic, but to which Hildebrand has given the more appropriate name of heterostyled; this class consists of plants presenting two or three distinct forms, adapted for reciprocal fertilization, so that, like plants with separate sexes, they can hardly fail to be intercrossed in each generation. The male and female organs of some flowers are irritable, and the insects which touch them get dusted with pollen, which is thus transported to other flowers. Again, there is a class in which the ovules absolutely refuse to be fertilized by pollen from the same plant, but can be fertilized by pollen from any other individual of the same species. There are also very many species which are partially sterile with their own pollen. Lastly, there is a large class in which the flowers present no apparent obstacle of any kind to self-fertilization; nevertheless these plants are frequently intercrossed, owing to the prepotency of pollen from another individual or variety over the plant's own pollen."

The wonderful variety of arrangements all tending towards the same end, so admirably summed up in the preceding paragraph, is sufficient, as Mr.

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\* "The Effects of Cross and Self-Fertilization in the Vegetable Kingdom." By Charles Darwin, M.A., F.R.S., &c. London: John Murray. 1876.



Darwin justly remarks, to warrant us in inferring that the plants referred to derive some great advantage from the process of cross-fertilization, and his present book is a record of the long series of experiments that he has undertaken with the purpose of ascertaining whether any such advantage does accrue to the plants by intercrossing, and if so, of what nature it may be. We may add that, from his observations, he is inclined to adopt for plants in general the aphoristic statement in which he summed up the results of his investigations of the Orchids: "Nature abhors perpetual self-fertilization;" but at the same time he by no means claims to be the absolute originator of this notion, which occurred to Andrew Knight as long ago as 1799, when he said: "Nature intended that a sexual intercourse should take place between neighbouring plants of the same species;" and subsequently both Kölreuter and Herbert entertained somewhat similar views. Still earlier, in 1793, C. K. Sprengel seems to have had an indistinct prevision of the prevalence of some such law as that enunciated by Darwin.

It would be impossible, without devoting to it more space than we have at command, to give anything in the shape of an analysis of the results published by Mr. Darwin in his present book, which is a wonderful record of patient investigation, directed by an intelligence of so high an order that one feels surprised, notwithstanding what we already know of Mr. Darwin's work, to see the two qualities involved in carrying on the researches and generalizing their results so strikingly combined in the same individual. Cross and self-fertilizations of innumerable flowers had to be effected, the seeds to be sown, the plants kept distinct, measured and weighed, and all these processes were continued in many cases through several generations, and the whole of the results obtained were then tabulated in such a manner as to show the evidence furnished by them for or against the opinion which the distinguished naturalist was desirous of testing. With but few exceptions the plants raised from cross-fertilized seeds had, as Mr. Darwin expected, an advantage, and often a considerable one, over those which sprung from seeds fertilized by the pollen of their own flower; but for the particulars of the experiments, many of which, having been made upon common garden plants, may easily be repeated by any one who feels an interest in such researches, we must refer our readers to the book itself. Many important observations are scattered through the volume, and the summary contained in the last four chapters is of great interest even to those who will not be at the trouble of studying the mass of facts given in the body of the book.

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#### BRITISH FUNGI.\*

THAT a third edition of Mr. Cooke's "British Fungi" has been called for is most certainly a matter for congratulation, as it is an indication that there must be an increasing number of people to whom the study of plants, as something more than pretty things, is of interest. This new edition has undergone but little alteration, but the text furnishes a good popular account

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\* "A Plain and Easy Account of British Fungi, with especial Reference to the Esculent and Economic Species." By M. C. Cooke, M.A., LL D. Third Edition, Revised. London: Hardwicke & Bogue. 1876.