

While these particular operations are in progress countless hoards of bacteria of various kinds are each exercising their natural functions in the rôle of destroyers or helpers, as the case may be. Surely we may think of the soil as a factory full of busy workers, causing incessant changes and modifications, rather than as a simple storehouse of accumulated riches.

The prosperity of peoples depends upon other factors than the fertility of the soil on which their homes are made, but those countries which are naturally most fertile furnish man more easily and more abundantly those things which may be used by him in increasing his power and in promoting his highest interests. In Illinois the local passenger traffic on the railroads is found to vary conspicuously with the difference over large areas in the quality of the soil, though all of the country is well populated. Not only is the number of the passengers in the regions of the best soils several times greater, but the difference in character of the men and women is also evident. The towns in the one case have great business houses, elegant residences, paved streets, electric railroads and lights, fine churches and school-houses, and a progressive, strong, hopeful and happy populace; while in the other these things are noticeably wanting, except in some measure the numbers of people. These take unconsciously a slower step, require more time in which to transact business and have less relish for physical or mental activity. They are evidently not so well fed and are in consequence really less capable of sustained exertion. Then, too, there is a stimulus in success itself which animates and inspires, while hopefulness is half the battle. Repeated failure of crops not only discourages the husbandman, but robs the entire community of life and push, and this is as true of mental and moral as

of physical activities. Soil fertility and man's virility are closely related. Therefore, since certain bacteria have been proved to have direct and very important connection with the former, they have in like measure evident and decided bearing upon the latter. If all flesh is grass, all nutrition as applied to man seems to be ultimately conditioned upon the activity of certain micro-organisms of the soil.

Man has proved himself to be a mighty master. Formerly the storm-tossed oceans toyed like bubbles with his contrivances and the great billows were barriers to navigation. Now the tempestuous waters are luxuriant pathways of travel, and down in their silent depths they pulsate from shore to shore with vibrant intelligence. Continents are spanned with iron and the massive locomotives thunder over the rivers and plunge under the mountains, defiant of opposition but delicately responsive to human control. How man has swept the forests from the face of the globe, and made at his will the wilderness to blossom as the rose! The earth, the air, the waters have yielded to him their secrets and the forces thereof have become the obedient servants of his commands. But master as he is, potent as is his sway, he never could have gained a livelihood, nor could he now long maintain existence on the earth, without the aid of myriads of invisible, though organized and living, silent though industrious and efficient agents of the microscopic world. It becomes him, therefore, to seek acquaintance with these beneficent creatures and to find ways and means of favoring their life-giving activities.

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SCIENTIFIC BOOKS.

*The Classification of Flowering Plants.* By ALFRED BARTON RENDLE, M.A., D.Sc., F.L.S., assistant in the department of botany, Brit-

ish Museum, and lecturer in botany at the Birkbeck College. Vol. I., Gymnosperms and Monocotyledons. Cambridge, at the University Press. 1904. Pp. xiv + 403. 8vo. 187 figures in the text.

The purpose of this book is stated by the author to be 'an attempt to give the student who has some acquaintance with the rudiments of botany a systematic account of the flowering plants.' By 'flowering plants' Dr. Rendle here means the seed plants, so that the pines, cedars, yews and their relatives are included under the term. That the author does not himself agree with this grouping is clearly shown in the preface, where he goes so far even as to doubt the paramount value of the seed character in classification. However, after expressing this doubt, he concludes 'on the present occasion' to treat the gymnosperms (pines, cedars, yews, etc.) and angiosperms (lilies, grasses, buttercups, pinks, mints, roses, parsleys and sunflowers) as parts of a single great group.

The first chapter, of about thirty pages, is given to a short historical statement of the development of plant classification. While brief, this is a useful summary, especially for those not having access to considerable libraries. The treatment is quite unequal. Thus a half page each is allotted to Robert Brown and John Lindley, and but a page to Endlicher, while to Van Tieghem and his singular systems are given more than five and a half pages. The system adopted by the author is essentially that of Engler in the third edition of his 'Syllabus der Pflanzenfamilien.'

The book is logically arranged, beginning with those groups which the author considers to be lower and primitive. Thus we have taken up first a discussion of the structure of the reproductive and vegetative organs of the Cordaitales, extinct since the Carboniferous period. Naturally the treatment is brief and incomplete for want of good material, but it must be said that the author has made the most of the little that we know of these primitive gymnosperms. Then follows a longer chapter on the Cycadales, in which the author confines his discussion wholly to the living forms. Next comes a short chapter on Ben-

nettiales, extinct since the Mesozoic period, followed by one on Ginkgoales, based mainly upon the single living, *Ginkgo biloba*, but with some reference to extinct species. In passing it may be noted that Dr. Rendle considers the structures on which the ovules of *Ginkgo* are borne to be axial. We much prefer Van Tieghem's interpretation of these structures as foliar in nature. The chapter on the Coniferales is by far the longest, as it should be. The usual morphological views are adopted, and the grouping of the genera is quite like that with which we are familiar. In regard to the nature of the seed-scale of the pines and their allies, the views of many investigators are given, and the whole is summed up by the statement that 'the view that the scale and ovule represent a secondary axis arising in the axis of the bract is at present the most generally accepted one.' In the treatment of Gnetales there is nothing new. The acceptance of the name *Tumboa* (instead of *Welwitschia*) is significant. A few years ago such an application of the 'law of priority' would have been most unlikely.

In taking up the angiosperms about fifty pages are given to a chapter devoted to their general morphology, in which we have considerable injection of modern morphology and terminology into what is for the most part a treatment along old lines. In reading the pages of this chapter one is impressed with the feeling that the author is condensing and abbreviating his discussion, with a consequent loss of clearness. For the student who has no more than 'some acquaintance with the rudiments of botany' many of the statements of the author will not be understood, and will have to be supplemented by much elucidation at the hands of his instructor.

The chapter dealing with the monocotyledons is well worked out, about two hundred pages being given to their morphology and classification. Following Engler's system the Pandanales are taken up first, with the remark that in them 'the flower is extremely indefinite' and that 'we have here presumably a primitive condition, prior to the evolution of the more typical arrangement.' The Helobiales follow with the usual treatment, in-

cluding the Hydrocharideæ. Under the Glumifloræ the grasses (Gramineæ) are described as having a solitary carpel, which is certainly an error for the three-styled genera, and probably so for those with two styles. Hackel's arrangement is followed. Curiously, in the sedges (Cyperaceæ) the carpels are described as 'three or two.' How these two views as to the nature of the pistil can be harmonized is difficult to make out.

The palms and aroids (Principes and Spathifloræ of Engler) are united into the 'series' Spadicifloræ. A curious typographical error occurs on page 250 (and is repeated on page 256) where the number of species of palms is given as 11,000! The treatment of the remaining groups (Farinosæ, Liliifloræ, Scitamineæ and Microspermæ) is in all essentials in accordance with that in Engler's 'Syllabus.'

The final chapter is devoted to a general review and to suggestions of affinities between the groups. This has not been well wrought out, and the student will be much confused by some of the statements. For example, while we are told that 'the Glumifloræ represent a primitive type,' and 'we may regard them as the stock from which the higher series have been derived,' we are told over and over again that the grasses are highly specialized. The diagram at the close of the chapter, while helpful in enabling us to understand the author's position, will scarcely help the student to an understanding of nature. According to it there are three monocotyledonous phyla, viz., (1) Helobieæ, (2) Pandanales, Spadicifloræ, (3) Glumifloræ, Farinosæ, Liliifloræ, Scitamineæ, Microspermæ.

Throughout the book, 'order' of Engler is given as 'series,' and 'family' as 'order,' in deference to time-honored English usage. Here again we prefer the German practise.

The book will be useful, and while it has defects, it is the result of much painstaking work, and must prove helpful to other workers.

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#### DISCUSSION AND CORRESPONDENCE.

##### CURRENTS OF THE NORTH PACIFIC.

TO THE EDITOR OF SCIENCE: I read with interest Dr. Bishop's letter on the source of the Pacific Coast current, and the hypothesis he proposes to account for it, in SCIENCE, of September 9.

The writer, like many others who have touched on ocean currents, does not make clear the distinction between the general system of oceanic circulation and ocean currents strictly so called.

The former is influenced by the rotation of the earth, differences of specific gravity and temperature in the oceanic mass, tides, the pressure of the atmosphere and various minor causes. The movement of Antarctic water northward in the Pacific belongs in this category, and we have no observations on record which would lead us to believe that the movement is other than very slow and gradual, or that it has any marked effect in producing the superficial streams of rapidly moving water which we call currents.

Oceanic currents are produced by the winds, by atmospheric pressure, and by the tides, modified by the presence of bodies of land. Permanent currents are due almost wholly to friction of permanent currents of air like the trade winds.

Dr. Bishop is quite right in supposing that the Kuro Siwo, like the Gulf Stream, does not extend across the ocean in which it originates. Nevertheless, the water of both, but especially of the Gulf Stream, has been traced thousands of miles beyond the point where the stream, *as a current*, has disappeared. It has been carried by the prevalent winds aided by the oceanic circulation.

The most complete collection of data for the North Pacific together with a discussion and chart may be found by Dr. Bishop in the report of the U. S. Coast Survey for 1880, Appendix No. 16, published in 1882, and to which little in the way of current data for the North Pacific has since been added.

The northwest trades, blowing hard and steadily for ten months in the year, carry the warm water, which the Kuro Siwo delivers in mid-ocean, to the northwest coast, which it