

The latter treatise and the *Electricity and Magnetism* of Maxwell have stimulated a wonderful activity in the study of mechanical ideas; and, as a result, a number of high-class elementary books on pure mechanics have appeared during the past decade. The work of Professor Ziwet is one of the best of this class. It is up to date and distinctively in touch with the progressive spirit of the age. In accordance with the modern order of presentation, Part I. is devoted to kinematics, Part II. to statics as a special case of dynamics, and Part III. to kinetics. No one acquainted with the magnitude of theoretical mechanics would expect to find a complete treatise even in the space of 600 octavo pages. It goes without saying, in fact, that he who would now do battle in the fields of mechanics should be armed with a battery of treatises. But it must be admitted that the work of Professor Ziwet covers the ground exceedingly well, giving a fairly good idea of nearly every important principle and process from the composition of vectors to the kinetics of variable systems. The mode of treatment, though distinctly analytical, is tempered by the introduction of geometrical illustrations and analogues where they serve to give clearness and fixity of ideas. A noteworthy feature of the work is the large number of references to the literature of the science. These references alone make the work one of the best that can fall into the hands of the enterprising student. The typography and press work are worthy of the distinguished publishers under whose auspices the volumes appear. A few misprints and a few inaccuracies of expression are visible in the work; but these are inevitable in a first edition of such a treatise. A speedy demand for a second edition will, we hope, enable the author not only to remove these trifling defects, but also to add an index, which will much enhance the value of the work for purposes of reference.

R. S. W.

From the Greeks to Darwin.—*An outline of the development of the evolution idea.*—By HENRY FAIRFIELD OSBORN.—Columbia University Biological Series 1.—New York and London, Macmillan & Co., 1894. Pp. 259. \$2.00.

This is a timely book. For it is time that both the special student and the general public should know that the doctrine of evolution has cropped out on the surface of human thought from the period of the Greek philosophers, and that it did not originate with Darwin, and that natural selection is not a synonym of evolution.

The author divides his work into six sections, entitled respectively: The anticipation and interpretation of nature; Among the Greeks; The theologians and natural philosophers; The evolutionists of the eighteenth century; From Lamarck to St. Hilaire; Darwin.

It is clearly shown that evolution has reached its present completeness as a result of a slow growth during the past twenty-four centuries, and that Darwin owes more to the Greeks than has been hitherto recognized by any of us. The Greek philosophers in biology, as in geology, anticipated, at least in some slight degree, modern scientific philosophy. The doctrine of continuity in the organic and inorganic world, anticipations of the monistic philosophy, and of the evolution of life, were taught by Thales and Anaximander, while Aristotle spoke of some of the factors of transformation, and even clearly stated the principle of the survival of the fittest, though he afterwards rejected it.

The father of evolution was Empedocles, who believed in spontaneous generation, that plants came first, that animal life long after budded forth from the plants, and in his poetry Osborn finds the germ of the theory of the survival of the fittest or of natural selection. Democritus perceived the principle of adaptation of single organs

to certain purposes, while Anaxagoras attributed adaptations in nature to intelligent design and was thus the founder of Teleology. But as Aristotle was the father of natural history so was he the first scientific evolutionist, being the earliest to conceive of the chain of being from polyps to man, a view afterwards generally held until Lamarck replaced it by his truer simile of a branching tree. The great Greek naturalist and anatomist understood the principle of adaptation of organs in its modern sense, discovered the law of the physiological division of labor, and conceived of life as the function of the organism; was not a vitalist; understood the doctrine of heredity, atavism or reversion; and finally, with all his errors and misconceptions, had vague notions of the unity of type, of nature, of gradations in nature, while the core of his views on evolution was the doctrine of an 'internal perfecting tendency,' which crops out in modern science in the writings of Owen, and even Koelliker, as well as others, including Weismann.

Passing to the evolutionists of the present century, Oken's place is, it seems to us, properly assigned; due credit is given to Buffon, who saw the force of isolation, and full credit to Erasmus Darwin, though sufficient stress is perhaps not laid on the fact that he was not a working zoölogist and had no followers. Osborn effectually disposes of the strong suspicion of Dr. Krause that Lamarck was familiar with the 'Zoonomia,' and made use of it in the development of his theory. He clearly brings out the fact, as stated by Martins, that Laplace supported Lamarck in the doctrine of the inheritance of acquired habits, as applied to the origin of the mental faculties of man, both of these authors anticipating Spencer, the doctrine being an old one, and expressed by De Maillet.

The statement of Lamarck's views is full and carefully drawn up, and his præmi-

nence as the founder of modern evolution, though he had no immediate followers, owing to his Cuvierian environment, clearly stated. This being the case, and in view of the fact that the number of Lamarckian evolutionists is now so great and constantly increasing, we should have wished that he had devoted still more space to one of the greatest naturalists of pre-Darwinian times, giving more quotations from his works.

Osborn controverts, and with success, we think, Huxley's dictum that Treviranus should be placed in the same rank as an evolutionist with Lamarck. We certainly do not hear of Treviranians. The statement of the views of Owen is fair, and yet we should scarcely use the word 'hostility' in stating his attitude towards Darwinism or natural selection. Owen refused to attack the *Vestiges of Creation* when that book appeared, but rather sympathized with the general views of its author. As Osborn states, "Owen was an evolutionist in a limited degree," somewhat in the manner of Buffon, and perhaps a shade more from his wide knowledge of paleontology, but it is to be borne in mind that neither was Koelliker nor were others, Darwinians as such, and there are many still who accept the general doctrine of evolution, but do not regard natural selection as an adequate or efficient cause, or at least consider it as only one of many factors.

While mentioning Darwin and Wallace as the leading selectionists no reference is made to the botanist Hooker, who, in his *Flora antarctica* arrived at the doctrine of transformation independently of Darwin, and became one of his two strongest supporters. Also Bates should have been mentioned.

The book should be widely read, not only by science teachers, by biological students, but we hope that historians, students of social science, and theologians will acquaint themselves with this clear, candid and catholic statement of the origin and early

history of a theory which not only explains the origin of life-forms, but has transformed the methods of the historian, placed philosophy on a higher plane, and immeasurably widened our views of nature and of the Infinite Power working in and through the universe.

A. S. PACKARD.

BROWN UNIVERSITY.

Materials for the Study of Variation.—WILLIAM BATESON.—London and New York, Macmillan & Co., 1894. xv + 597 \$6.50.

Over thirty years ago Mr. Darwin outlined the great problems for investigation in natural history, and, one after another, these lines of investigation have been studied by naturalists. Embryology, paleontology and systematic classification early attracted the attention of many naturalists, and these branches of investigation have been very thoroughly studied in the last quarter of a century. Geographical distribution was made a special subject of research by Mr. Wallace and others. These various lines of study, while, of course, they have not been exhausted, have certainly been studied to such an extent that most of the valuable lessons which they teach have been learned. In recent years also another factor of the evolution problem, namely, that of heredity, has been the subject of eager research by various naturalists. It is somewhat strange that the problem of variation has been so universally neglected except by Darwin's *Animals and Plants*. It is upon variations in animals that the whole of the theories of Darwin and all evolutionary doctrines are based, but while the last thirty years has seen much speculation as to variations, both concerning their causes and distribution, while many illustrative instances have been accumulated, while nearly all the modern theories of evolution are based directly upon certain conceptions of variation, there has been no systematic attempt to study

this fundamental problem. Speculative zoölogy has always a greater attractiveness to most minds than the more laborious and less entertaining work of collecting facts. The last twenty-five years has seen an abundance of publications upon evolution from theoretical grounds, and while variations themselves have been discussed on both sides of the Atlantic, these discussions have been almost universally based upon a few stock illustrations, and must be recognized as without any proper foundation in facts. Natural science is certainly indebted to Mr. Bateson for having taken up at last this branch of research which lies at the very foundation of the origin of species. Mr. Bateson's book has a very modest title, and the author simply claims to have brought together materials out of which a theory of the origin of species may in the future be built. But this is the only systematic attempt yet made to study variations themselves. The present volume is only the first instalment, and we are promised more in the future. A book of nearly 600 pages, filled with numerous illustrations, describing in more or less detail variations of all kinds, in all types of animals, will certainly find its way into the library of every naturalist who has any interest in speculative thought.

A review of this character is hardly a fitting place to discuss the subjects presented in this work. In reading over its pages there are, however, three or four striking conclusions of so much general theoretical importance that they may be selected as the teachings of this first volume. Most prominent among them stands the deduction of the author that variations are discontinuous. It is the theory of Darwin, and, in general, of his followers, that species were produced by natural selection acting upon slight continuous variations. The difficulties of this thought were plain to Mr. Darwin, and have become more plain