

duced sufficient heat not only to melt up their own substance, but a good deal of that comprising the adjacent lunar surface, and then adds "having established then the fact that giant meteors may have fallen on the earth and may have melted up tracts of country which would be deluged with lava—we may legitimately enquire whether there are any evidences of such occurrences on the earth's surface." He considers that the tufas, lavas and agglomerates in the Archæan of Great Britain, the great lava sheets of the Snake River in Idaho and those of the Kapte Plains of British East Africa may eventually prove to have had such an origin. It is even considered a by no means impossible theory that the New Caledonian nickel deposits are portions of a gigantic meteor which fell long ages ago and which by earth movements has been so crushed and folded that it has all the appearance of an igneous dyke.

The origin of the water on the earth's exterior and the part which it plays in modifying the earth's surface, is then taken up and the recent work of various investigators is well presented and discussed. In referring to the fact that during the weathering of rocks the lime which they contain tends to go into solution more readily and thus to be more completely removed than the associated magnesia, the author gives it as his opinion that in the processes of solution and redeposition the lime tends to pass upward and outward in the earth's crust while the magnesia most frequently passes downward, and adds "Why it goes downward is at present entirely a mystery; from an analogy with iron one might suggest that the magnesium of the earth's nucleus exerts an attraction and thus draws it downward," for the author holds that when compounds of iron are dissolved they become ionized and that the great central mass of metallic iron within the earth "must thus exert a pull on the iron in solution, and this pull lasting over innumerable myriads of years, yet ever persistent and increasing, would gradually draw downwards the ions of iron as they become formed in the surface water of the earth."

In treating of the work of underground water, Mr. Schwarz accepts Posepny's theory of the origin of ore deposits and believes it to be the explanation which is now adopted by an ever-increasing body of geologists.

The subjects of earth folds, the earth's surface, cold volcanoes, normal volcanoes, earthquakes and Archæan rocks are then taken up in succession. Many statements are made which are highly debatable and some of which are certainly incorrect. The book, however, is well written and is worthy of perusal by all geologists interested in the fundamental problems of the origin of the globe, although one can hardly agree with the author when he says that the work "constitutes an appeal for a return to rationalism after a period of romanticism," for in it the romantic element is developed in a manner as striking and interesting as in any of the modern treatises of the more orthodox school.

FRANK D. ADAMS

A Text-book of Psychology. By EDWARD BRADFORD TITCHENER. New York, The Macmillan Co. 1910. Pp. 565.

The review of a text-book, like the book itself, reflects a personal equation. The fate of a text is a venture, sharing somewhat in the psychology of advertising. However good the article or inviting the appeal, the test comes in its reception. It is legitimate to appraise a text in terms of its intrinsic merits in form and content and execution; it is equally legitimate to consider its service. For the purpose of ever so good a text is bound up with its use. It must first appeal to the instructor; yet he tests it practically and is prepared to revise his judgment. The comments of the users might be gathered by the questionnaire method, with anonymity to secure frankness of statement.

In a science like psychology, with traditions in the making and doctrines appreciably shifting, yet with essential principles of large scope and sufficient definiteness, the makers of text-books have wide latitudes. It is easy to find agreement that the purpose of the text is to help the student from a casual to a system-

atic and more adequate understanding of the mental processes. There is little agreement as to the best means of accomplishing it. Each in his way assents that such helpfulness must respect the attitude of the student, while yet exercising to the full the privileges of wise and even stern leadership. Any given text is the author's advocacy of the ways and means he regards as best suited to set the youthful mind psychologizing with greatest profit. These platforms differ decidedly, and as Professor Titchener indicates, are dependent upon temperament. Yet his own classification of texts is more a matter of policy. He notes three types: those that adhere to systematic principles and make much of traditional observation; those that simply compile experimental data; those that lean heavily on experiment but interpret conclusions in theoretical analysis. His own text belongs to the last group.

Objectively it is readily described. The present volume replaces the "Outlines of Psychology" (1896), shows a thorough rewriting with much use of recent reconstruction, and carries out yet more rigidly the determination to "set experimental methods and results in the forefront of discussion." This decision is reflected in the space distribution of topics. Two fifths of the text is devoted to Sensation and assumes a knowledge of the sense-organs. (The functions of the nervous system are omitted as equally to be elsewhere acquired.) Affection together with Attention occupies seventy-five pages; and the same space is devoted to Perception. Something less than a third of the pages consider Association, Memory, Imagination, Action, Emotion and Thought. The psychology is structural; and construction lines and architectural details are emphasized; the theories of their interpretation professionally discussed; the technique of method expounded. The student is taken in hand as one ready to proceed as far as he can, toward the same kind of insight and interest that the professional psychologist has acquired. There is good precedent for this attitude in the texts of other experimental sciences. No one is better

equipped to lay out such a course than Professor Titchener. Those who agree with him that this is the course to be pursued may unhesitatingly adopt his text as an able, judicious and logical guide. Even more may be added: so adequately does this text represent what can and should be done and said and considered in conformity with the fundamental position of the author, that the entire method may be said to stand on trial in this volume. It represents the best products of ripe scholarship and of the comprehensive utilization of recent advances. Professor Titchener informs us that the present volume was insistent demanded by colleagues and pupils and publisher. Let that answer for the service which it has performed and is destined to perform.

The present reviewer has no desire to intrude his personal equation unduly. Though he shares with Professor Titchener the confidence in the value of the experimental data, and in the attitude thus enforced, he takes his stand with those who believe that a very different kind of text-book will alone serve the pedagogical purposes in view. In the emphasis of the functional aspects of mental phenomena; of their setting in common experience and observation; of the thoroughgoing acquisition of principles (quite enough of which are sufficiently established for the student's needs); of the avoidance of refined details and controversial positions; of the minimizing of theoretical dissection; of the provision of a fair perspective of the field of mind as a living, significant part of the world; in all this and much more he takes his stand with the other wing of the psychological party. In an experience with several thousand students, he recalls but a handful willing or able to absorb such psychological proficiency as they aspired to, through the plans and specifications furnished by this order of text. He believes that psychology presents as characteristic differences from as points of community with the instructional methods of other sciences; that the text-book writer may more safely overrate the distinctions than the resemblances. Both in view of students as they are, and of instruction functionally consid-

ered, he regards the demand for an almost diametrically opposed type of presentation as justified. None the less, he is grateful for the availability of so admirable a text, written under so different an inspiration. The student with a fair foothold on the subject will here find the means of strengthening his grasp upon the problems arising specifically from the experimental issues.

JOSEPH JASTROW

LOUIS AGGASIZ'S LATER VIEWS ON THE
CLASSIFICATION OF FISHES

WRITERS on ichthyology have expressed two distinct views concerning Louis Agassiz's work on the fishes. On the one hand, they have praised his contributions to descriptive ichthyology and his masterly work on the fossil forms; on the other, they have condemned his classification—declaring that a system which rests solely upon differences in scales is superficial and unphilosophical, and, even for his day, was a step backward, rather than forward.

But in thus condemning Louis Agassiz's views an injustice is done him, for he is credited only with the classification he elaborated early in life (in his "Poissons Fossiles," 1833-1844), but later abandoned and, in fact, repudiated. No cognizance is taken of his maturer views expressed many years later, at a time when he had ceased to contribute in any marked degree to the descriptive side of his science. One reason for this neglect of his later views is the fact that they were not elaborated in detail, but presented in bare outline before various societies; and are scattered in a dozen or two paragraphs through the proceedings of these societies. It is worth while, it seems to the writer, to bring together these later views of Agassiz and to indicate the steps by which he arrived at them.

As is well known, Louis Agassiz's larger works on the fishes were published in Europe. After coming to America he occupied himself chiefly with the invertebrates. None the less he never lost sight of his favorite group and continued his observations in it whenever opportunity offered. But he worked at so many

subjects and with such haste that he never found time to elaborate all these observations. Except for three or four short papers¹ in which results were presented in more or less detail, his views on the fishes were set forth briefly. In the Proceedings of the American Academy of Arts and Sciences, and of the Boston Society of Natural History, during the fifties and sixties, are scattered numerous condensed records of his observations, some of great interest.

His earliest allusion to his first classification is found in a communication which he made in 1850² to the American Academy of Arts and Sciences, on the scales of the bonito. He showed that these scales are intermediate between the *ctenoid* and the *cycloid* types, the serrations being marginal only and not traversing the whole posterior portion of the scale.

In 1857³ he announced that he had given up the classification of fishes by their scales and proposed a new classification which he said was founded upon embryological characters—although he did not specify what these characters were. He divided the fishes into four *classes*: (1) Selachians, (2) ganoids, (3) fishes proper, (4) myzonts [= cyclostomes].

This system, if we allow for the changes wrought since Agassiz's day in the group of the ganoids, is not much different from our modern ones. In ranking his groups as classes he was ahead of his time. There is a tendency at the present day to make the Cyclostomes and the Selachians, classes,⁴ equivalent in rank to the class Pisces proper. Such a view, for instance, has recently been urged by Gill and, as far as the Selachians alone are

¹ A summary of these is given by Jordan in his "Agassiz on Recent Fishes," in the *American Naturalist*, XXXII., 1898, pp. 173-176.

² *Proceedings*, II., p. 238.

³ *Proceedings Academy Arts and Sciences*, IV., pp. 8-9.

⁴ It does not appear that Louis Agassiz used the word class with precisely the same connotation as given to it to-day. It was then used somewhat more loosely. However, this does not depreciate the value of his conclusion that these four groups are of equivalent rank.