SCIENCE

FRIDAY, APRIL 14, 1899.

CONTENTS:

MSS. intended or publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson N. Y.

*A SAGE IN SCIENCE.**

BROOKS' lectures on the Foundations of Biology constitute a book that will live as a permanent addition to the common sense of science. It belongs to literature as well as to science. It belongs to philosophy as much as to either, for it is full of that fundamental wisdom about realities which alone is worthy of the name of philosophy. Writers of literature have been divided into those with quotable sentences, as Emerson and Thoreau, and those whose style runs along without break in the elucidation of matter in hand, as Hawthorne and Irving. To the former class Brooks certainly belongs. His lectures are full of nuggets of wisdom, products of deep thought as well as of careful observation. There is not an idea fundamental to biology that is not touched and made luminous by some of these sagacious paragraphs. Whether it be to show the significance of some unappreciated fact, or to illustrate the true meaning of some complex argument, or to brush away the fine-spun rubbish of theory, the hand of the master is seen in every line.

The main lesson of the work is that to believe is not better or nobler or higher

* The Foundations of Zoology, by William Keith Brooks, Ph.D., LL.D., professor of zoology in the Johns Hopkins University. A course of lectures delivered at Columbia University on the Principles of Science illustrated by Zoology. New York, The Macmillan Company, 339 pages; price, $2.50.

than to know. Belief adds nothing to certainty, and whatever is really true is the very best thing that could be true, else it had not been so. Dr. Brooks sees no reason for hoping, fearing or wishing in regard to truth. So long as it is true we can ask nothing better, and no new truth can be subversive of anything worth keeping in our previous stock of beliefs and inductions.

Dr. Brooks shows in many cases that problems over which scientific men have worried for years without result are at bottom mere questions of words. The facts at issue are recognized by all, but the matter of their final interpretation is one of the ultimate truths which science can never find out, for man can come in contact with no ultimate truth of any sort.

There is another class of problems which can never be settled by argument. We must wait until we know the truth. One of these concerns the existence of a principle of life which distinguishes vital processes from the operations of ordinary chemistry and physics. "Many biologists," says Brooks, "find their greatest triumph in the doctrine that the living body is a 'mere machine;' but a machine is a collocation of matter and energy working for an end, not a spinning toy; and when the living machine is compared to the products of human art the legitimate deduction is that it is not merely a spinning eddy in a stream of dead matter and mechanical energy, but a little garden in the physical wilderness; that the energy localized in *living* bodies, directed by similarly localized *vitality*, has produced a collocation of other material bodies which could not be brought about in a state of physical nature, and that the distinction thus drawn between the works of non-vital nature and those of life is both useful and justifiable. What this distinction may mean in ultimate analysis I know no more than Aristotle and Huxley; nor do I believe that any one will ever know until we find out. One thing we may be sure of, that it does not mean that the living world is anything but natural." Here he quotes from Aristotle, "That is natural *which holds good*, either universally or generally." If anything occurs, it is, therefore, natural.

"Faith and hope are good things, no doubt," says Dr. Brooks, "and 'expectation is permissible when belief is not;' but experience teaches that the expectation or faith of the master is very apt to become belief in the mind of the student, and 'science warns us that the assertion that outstrips evidence is not only a blunder but a crime.'" The key-note to the series of lectures is found in the introductory sentence that "life is response to the order of nature." "I should like to see hung," he says, "on the walls of every laboratory Herbert Spencer's definition to the effect that life is not protoplasm but adjustment; or the older teaching of the father of zoology, that the essence of a living thing is not what it is made of nor what it does, but why it does it."

The study of biology is the study of response and adaptation. The study of structure is the consideration of concessions to environment. The phases in development are related to the stimuli, external or internal, on which they are conditioned.

"It follows that biology is the study of response, and that the study of that order of nature to which response is made is as well within its province as the study of the organism which responds, for all the knowledge we can get of both these aspects of nature is needed as a preparation for the study of that relation between them which constitutes life."

The long dispute as to the inheritance of acquired characters is fairly closed by the words of Dr. Brooks. The arguments drawn from philosophical or analogical considerations are all brushed away, and

we are brought to the plain fact that no such inheritance is yet known to take place, and no one can yet say that it does not. "I find," he says, "as little value in the *a priori* arguments of those who hold that 'acquired characters' cannot be inherited as I find in Haeckel's assertion that 'belief in the inheritance of acquired characters is a necessary axiom of the monistic creed.'" In other words, *a priori* arguments are simple expansions of definitions or assertions, and can have no validity beyond that of the statements from which they are drawn. There is no truth to be derived from argument, *a priori*. If it is truth it is already known and needs no argument.

Dr. Brooks sums up his final conclusion that, whether "it be a real factor or not, the so-called Lamarckian factor (inheritance of acquired characters) has little value as a contribution to the solution of the problem of the origin of species, and renewed study has strengthened this conviction."

Dr. Brooks has a suggestive and valuable chapter in reproof of those who would place the law or principle of evolution as something apart or above the forces which are known to bring about orderly change or adaptation in living organisms.

"The tendency to regard natural selection as more or less unnecessary or superfluous, which is so characteristic of our day, seems to grow out of reverence for the all-sufficiency of the philosophy of evolution, and pious belief that the history of all living things flows out of this philosophy as a necessary truth or axiom.

"As no one can say that the basis for it [the philosophy of evolution] is not true, and as it seems much more consistent with scientific knowledge than any other systems of philosophy we must admit that, for all we know to the contrary, it may be true; and we may ask whether, if true, it is any substitute for science; although we must remember that there is no end to the things which, while no one treats them seriously, may nevertheless be true. * * * While anything which is not absurd may be good poetry, science is founded on the rock of evidence.

"So far as the philosophy of evolution involves belief that nature is determinate or due to a necessary law of universal progress or evolution, it seems to me to be utterly unsupported by evidence and totally unscientific.

"Men of science repudiate the opinion that natural laws are rulers and governors over nature; looking with suspicion on all 'necessary' or 'universal' laws."

Again he says, "Natural laws are not rulers or governors over nature, but generalizations from an experience which seems to teach, among other things, that progress is neither necessary nor universal.

"The hardest of intellectual virtues is philosophic doubt, and the mental vice to which we are most prone is our tendency to believe that lack of evidence for an opinion is a reason for believing something else. This tendency has value in practical matters which call for action, but the man of science need neither starve nor choose."

Most suggestive chapters are those on the mechanism of nature with reference to Paley's famous argument for design in nature, and the varied changes which the argument for teleology has undergone. There is a constant plea against reading into the relations of nature more than is actually seen there, as also against the denial of that which may occur and yet has not been actually seen.

"We can give no reason why life and protoplasm should be associated except the fact that they are. And is it not equally clear that this is no reason why they may not exist separately?" In this connection we are given a charming analysis of the idealism of Agassiz, with the reason why

his wide-reaching suggestions have found so little favor among later naturalists.

"In order to prove that natural history is a language which we learn and listen to, to our entertainment and profit and instruction, he holds it essential to prove that it is *nothing but* a language; that the relations between living things and the world about them, being ideal relations, cannot possibly be physical ones also; that our 'laws of biology' are not 'necessary' but 'arbitrary.'"

The belief in Monism which Haeckel places first in his articles of scientific faith naturally wakens in Dr. Brooks little response. It is a philosophical expression wholly unrelated to reality. Whether it is the highest of all possible human generalizations or a mere play on words, science has no means of deciding, and man has no other court of appeal save his own experience.

I have already reached the limit of my space, while the majority of the passages I had marked for quotation are still untouched. The stones which Dr. Brooks has chosen as 'Foundations of Zoology' will remain there for centuries, most of them as long as human wisdom shall endure. The volume is a permanent contribution to human knowledge, the worthy crown of a life of wise thought as well as of hard work and patient investigation. If there are any errors in statement or conclusion, from one end of the book to the other, the present writer is not astute enough to find them out, and Dr. Brooks' logic may permit him at least to doubt their existence.

The biologists of America have long since recognized Dr. Brooks as a master, and this volume, the modern and scientific sequel to Agassiz's 'Essay on Classification,' places him in the line of succession from the great interpreter of nature, whose pupil and friend he was.

David Starr Jordan.
Stanford University.

FIELD-WORK OF THE JESUP NORTH PACIFIC EXPEDITION IN 1898.

The Jesup North Pacific Expedition was organized in 1897 by Mr. Morris K. Jesup, President of the American Museum of Natural History, for the purpose of investigating the ethnology and archæology of the coasts of the North Pacific Ocean between the Amoor River, in Siberia, and Columbia River, in North America, the whole expense of the expedition being defrayed by Mr. Jesup.

During the year 1897 the field-work of the expedition was confined to the coast and interior of British Columbia. In 1898 the work was taken up on a more extended scale. Parties were in the field on the coast of the State of Washington, in the southern interior of British Columbia, on the coast of British Columbia, and on the Amoor in Siberia. On both continents ethnological work as well as archæological work has been done. While the parties in charge of the work on the American continent returned with the beginning of the winter, the work in Asia is being carried on.

The collections made by the various field parties of the expedition in 1897 are now on exhibit in the American Museum of Natural History. These collections represent the results of archæological work in the interior of British Columbia and on the coast. The ethnological collections are particularly full in regard to the tribes of Thompson River, of northern Vancouver Island, and of the central parts of the coast of British Columbia. The Museum has commenced the publication of the scientific results of the expedition in the form of memoirs. Up to this time two numbers have been issued—'Facial Paintings of the Indians of Northern British Columbia,' and 'Mythology of the Bella Coola Indians,' both by Franz Boas. Other results of the explorations in 1897 are in preparation, and will be issued in the course of the year.