

these things, as the diversion of attention in directions wholly foreign to that in which their original work lies, and the destruction of that unconscious cerebration which is one of the most important factors in working out scientific results.

At the same time I fully recognize that a university is also a body of students that must be systematically taught, and I do not think that the work of the effective teacher should be considered as in any way inferior to that of the investigator, nor should professors whose first instinct is that of the teacher, be led to feel that their advancement depends on the accomplishment of original work.

You doubtless know better than I that investigation that is done under pressure of this kind is oftentimes a rather poor pretense. The tendency seems to me to be to differentiate these two types of university professors, and it is probably on the whole a good division of labor.

One thing seems to me quite certain, and that is that our universities will not attain their real aim until they are prepared to give full opportunities for research to men of the first type I have indicated. These are the men who form the real nucleus of the university, and their presence and labors seem to me of more importance from the point of view of real university work than all the rest of our educational machinery put together.

President Woodward, of the Carnegie Institution, says:

The way I put it to myself is this: Can we expect a college professor to do as good work of research for our institution as we might expect from him if he were taken over to the institution and had no work but that of research? Much experience convinces me that work of instruction is very valuable to a man who is pursuing investigation. On the other hand, I find that most men who are pursuing at once work of instruction and investigation in the colleges are giving only the smaller fraction of their time to investigation. Their first duty is toward the institutions with which they are connected, and any man who is efficient as an investigator is also likely to be efficient as an administrator and as a worker on the numerous committees essential to educational institutions. My personal experience and observation would seem to show that here again the work of investigation is commonly given second place.

On one point there is little or no room for

doubt, namely, that the work of investigation done by professors and instructors in our American universities has only lately come to be justly appreciated, especially by trustees and regents.

From the point of view of an educational institution, there is likewise another point quite clear to me, namely, that no man can be an instructor of the highest grade without he is also simultaneously at work in some sort of research connected with his work of instruction.

Here I must close my quotations, resisting all temptation to continue. For in fifty other letters I find important considerations pithily stated. But as these all agree more or less distinctly with my own thesis, I must suppress them for the present on the principle adopted some ten centuries ago in burning the library at Alexandria.

SCIENTIFIC BOOKS.

The Dynamics of Living Matter. By JACQUES LOEB. (Columbia University Biological Series, VIII.) New York, The Columbia University Press. 1906. The Macmillan Company, agents.

This interesting book owes its origin to a series of eight lectures delivered by the author at Columbia University in the spring of 1902. The aim of the lectures was to give a presentation of the author's researches on the dynamics of living matter and the views to which they led him. In the present book, however, Loeb gives quite a complete survey of the modern problems of experimental biology, records a great many interesting facts and laws which were recently discovered in this field and discusses them from a broad point of view. The book still retains the division into lectures which are here extended to twelve.

The following quotations from the introductory remarks (lecture I.) inform us of the philosophical attitude of the author towards biological problems. "In these lectures," he says, "we shall consider living organisms as chemical machines, consisting essentially of colloidal material, which possess the peculiarities of automatically developing, preserving, and reproducing themselves." He

says further that we must admit "that nothing contradicts the possibility that the artificial production of living matter may one day be accomplished. It is the purpose of these lectures to state to what extent we are able to control the phenomena of development, self-preservation and reproduction. * * * We shall only go far enough to satisfy ourselves that no variables are found in the chemical dynamics of living matter which can not be found also in the chemistry of inanimate nature."

In lecture II. the author deals with the general chemistry of life phenomena. Ferments and oxidation are the chief subjects of discussion. The idea of 'catalytic processes between tissues and liquids' was introduced by Berzelius, and Ostwald has shown that catalyzers do not initiate, but only accelerate reactions. The discovery by Crofton Hill and by Kastle and Loevenhart of the reversible action of enzymes is discussed; and also the observations by Neilsen of the reversibility of action by an inorganic catalyzer (platinum black) and that the effects of certain poisons are the same for both organic and inorganic catalyzers. Respiration as a catalytic process is considered. The possibility of two groups of oxidizing catalyzers is suggested: one, of the type of the peroxides, may be present in the protoplasm; and the second, which can act indefinitely as oxidases, may be found in the nucleus. Loeb calls attention to the fact that oxygen not only supplies potential and kinetic energies, but is also important for cell division and growth, and acts as 'protective' agent. Lack of oxygen causes structural changes. Experiments which show the production of CO₂ by enzymes are reported. Concerning the theory of enzyme action Loeb gives a brief statement of the attempt in the stereochemical direction; but he is rather inclined to accept the theory of intermediary reaction. Everything seems to indicate that enzymes form unstable combinations with the bodies whose reactions they accelerate.

In lecture III. under the head of the general physical constitution of living matter are discussed: the limits of divisibility of living matter; Bütschli's views that living proto-

plasm has the structure of a microscopic emulsion; the colloidal character of living matter; the formation of semipermeable membranes. Loeb gives here the Meyer-Overton theory of anesthesia with which he does not fully agree. "The rapidity of the absorption of narcotics may be due to their solubility in oil, and yet the effect they produce may be due to something entirely different." With regard to the rôle of osmotic pressure and the exchange of liquids between the cell and the surrounding liquid, to the discussion of which a few pages are devoted, it may be mentioned that Loeb says he now believes 'that contractile phenomena inside the cell furnish at least part of the energy of secretion and absorption in those cases where the osmotic forces alone can not explain these phenomena.' In the same lecture an account is given of Loeb's extensive experiments on the antagonistic effects of salts.

In lecture IV. some physical phenomena of life are discussed: the theories of muscular contraction, of protoplasmic motion, of cell division; the origin of radiant energy (phosphorescence) and the electrical phenomena in living organisms.

Lecture V. is on the rôle of electrolytes in the formation and preservation of living matter. Loeb gives here among other things a condensed but clear account of the very extensive and important studies by himself and his pupils on ion-proteid compounds and their relations to contractile tissues. The articles dealing with these subjects are very numerous and scattered in many publications, not all of which are easily accessible. The knowledge of these articles is quite indispensable for a student in general physiology. It is gratifying, therefore, to have an authoritative account of the entire subject presented in only thirty pages.

Lecture VI. deals with the effects of heat and radiant energy upon living matter.

Lectures VII. and VIII. are devoted to a discussion of the different tropisms, to the knowledge of which in the animal world the author has, as is well known, contributed pioneer work.

In lecture IX., on fertilization, the reader will find among other things a lucid account

of the experiments which led up to and established the epoch-making discovery of artificial parthenogenesis.

In lecture X., on heredity, the following subjects are discussed: the hereditary effects of the spermatozoon and eggs; Mendel's important experiments; the mutation theory of de Vries; the determination of sex; the relation of egg structure to heredity; the observations and experiments of Driesch and E. B. Wilson. It does not seem to Loeb 'that a discussion as to the relative influence of protoplasm and nucleus upon heredity will prove very fertile, but that it is necessary to transfer this problem as soon as possible from the field of histology to that of chemistry or physical chemistry.'

Lecture XI. is on regeneration. Here again the author has done a good deal of original investigation and in some parts, as on heteromorphosis and on the influence of the central nervous system, Loeb has done pioneer work. He discusses the subject from the point of view of Sachs's hypothesis of the formation of organs. Loeb here refers the reader to Morgan's writings on regeneration.

In his concluding remarks (lecture XII.) Loeb says among other things: "There is, therefore, no reason to predict that abiogenesis is impossible, and I believe that it can only help science if the younger investigators realize that experimental abiogenesis is the goal of biology. On the other hand, * * * it is not sufficient for this purpose to make proteins synthetically, or to produce in gelatine or other colloidal material round granules which have an external resemblance to living cells."

It is a very interesting book which instructs and at the same time stimulates the reader to independent thinking.

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SCIENTIFIC JOURNALS AND ARTICLES.

The American Naturalist for July contains but two articles, 'Adaptive Modifications of Occipital Condyles in Mammalia,' by Charles S. Mead, and 'Living and Fossil Species of *Comptonia*,' by Edward W. Berry. The former notes the general adaptations of the

condyles to permit the movement of the head, the special modifications for carnivorous habits and the arrangement of the condyles in different orders. The second paper is an attempt to work out the relations of such forms as may be referred to *Comptonia*, discusses the succession of forms and includes descriptions of the species admitted by the writer, with their synonymy.

The Museums Journal of Great Britain for June has 'Some Notes on a recent Trip to Greece and the Greek Islands,' by Robert F. Martin, an article on 'National Art Patriotism,' dealing with the purchase of a 'Venus and Cupid' ascribed to Velasquez for £45,000, secured for the National Gallery through the National Art Collections Fund, and an account of the 'New Natural History Museum for Salford.' The organization of the American Museum Association is noticed, and it should be said that the Museums Association of Great Britain cabled its best wishes for the successful inauguration and future progress of the sister society. There is a very considerable instalment of the British Museums Directory, which includes such national institutions as the British Museum, Victoria and Albert Museum and others.

THE leading article in the *Journal of Nervous and Mental Disease* for July is a paper by Dr. Waldemar Heinrich Groszmann on 'The Position of the Atypical Child.' Dr. Groszmann defines his terms very carefully, giving in tabular form a survey of the entire range of child variation. He emphasizes the fact that the atypical condition is a transitive one and tends to become permanent either in the direction of abnormality or of some degree of typicality. He finds it impossible to educate successfully such children in the ordinary public and private schools in conjunction with home environment, and believes that the solution of the problem lies in the institution where the environment can be controlled and adapted to the end in view. Dr. Archibald Church reports a case illustrating the neuritic type of progressive muscular atrophy with a marked heredity, and a second on syringomyelia with involvement of cranial nerves,