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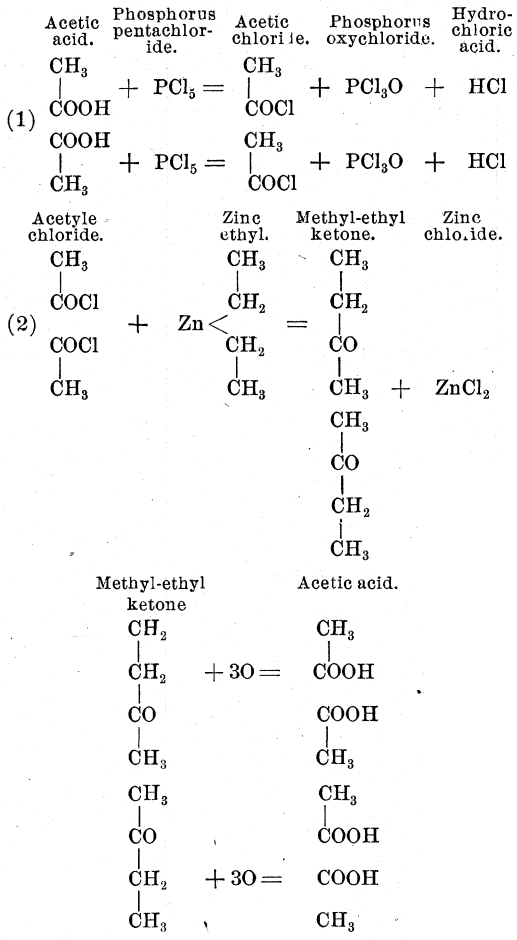
SCIENTIFIC BOOKS.

Les problèmes de la vie. 1re Partie. La Substance vivante et la cytodiérèse. Par DR. ERMANNO GIGLIO-TOS. Turin. 1900.

A title, such as the author of the present volume has selected, is apt to excite suspicion by suggesting a discussion of phenomena for the explanation of which the data at our disposal seem at present hardly sufficient. The time when the biologist was content with an *ignoramus* or with the endeavor to conceal his ignorance under cover of vital force has passed away, and a school has arisen which pins its faith on the investigation of Entwicklungsmechanik, but which, it must be confessed, still subsists on the substance of things hoped for. The pendulum has swung from the predication of a special force to the application of the fundamental principles of physics and mechanics, but without as yet yielding the desired explanation of protoplasmic activity, possibly because the new position has not yet been sufficiently exploited.

Professor Giglio-Tos, however, believes that the lack of conclusive results is due to the pendulum having swung too far; the basis of an explanation of the phenomena of life is to be sought, in his opinion, not so much in the physical as in the chemical principles involved. The most fundamental of all the vital functions is assimilation and this he believes is exclusively a chemical phenomenon, perfectly analogous to the changes which organic chemical compounds may be made to undergo in our laboratories, acetic acid, for instance, if supplied with the proper food in the way of reagents, assimilating these and producing with their aid additional molecules of acetic acid. The example which he gives in illustration of the chemical nature of assimilation is so suggestive that it may be repeated here.



Thus *two* molecules of acetic acid supplied with the proper food (phosphorus pentachloride zinc ethyl and oxygen) have been able to assimilate additional atoms of CH.O, the result being the formation of *four* molecules of acetic acid (growth), together with certain excreta (phosphorus pentachloride, hydrochloric acid and zinc chloride). Arguing for this case, Professor Giglio-Tos lays down the following conditions as necessary in order that a molecule may exhibit the phenomena of assimilation :

1. It must be able, with the aid of assimilation, to divide into molecules similar to itself.

2. The necessary nutritive substance must be always present.

3. The nutritive and secondary (excreta) products must not act destructively upon each other.

4. The various processes of assimilation must follow one another in a definite order.

5. The physical conditions (heat, light, etc.) must be suitable.

The molecules of protoplasm, which are termed *biomolecules*, possess or exist under these necessary conditions and hence exhibit assimilation.

Having established this point, the author then proceeds to discuss differentiation. If we represent the primary molecule by a and the various compounds formed during the assimilative process by b, c, d, and M, the process indicated above may be graphically composed as

$$a \cdots b \cdots c \cdots d \cdots M = a + a$$

It is not necessary, however, that the resulting molecules should be identical in composition with that from which they arose, and the series may run thus :

$$a' \cdots b' \cdots c' \cdots d' \cdots M' = e' + e'$$

and finally it is possible that the two resulting molecules may differ from one another, thus

$$a'' \cdots b'' \cdots c'' \cdots d'' \cdots M'' = e'' + i.''$$

As a combination of these various results of assimilation, which the author terms respectively autogenetic, homogenetic and heterogenetic, the differentiation of the biomolecules is produced. The biomolecules represent for Professor Giglio-Tos the fundamental constituents of protoplasm, but they are chemical constituents, and like many of his predecessors he finds it necessary to postulate the existence of living particles composed of an aggregation of biomolecules and which he terms *biomores*. These he likens to a double salt and, since each biomore is composed of living molecules, it too is a living compound, and from the biological standpoint may be regarded as a symbiosis of molecules, since for the preservation of the biomore the component biomolecules must react favorably upon one another. The biomores are aggregated symbiotically to form a *bioplasma* and a symbiotic system of biomores which performs all the functions of life and constitutes a living unit, is termed a *biomonad*, while, finally, a *cell* is a biomonad 'characterized by the chemical nature of certain biomores which form its nucleus' or in other words is a differentiated biomonad.

Such in brief is the fundamental idea which the author expounds in the first five chapters of his book, and in the succeeding pages he proceeds to discuss the phenomena of cell division in the light of this idea. Reproduction is after all merely discontinuous growth and the causes which determine the growth or division of a molecule will be the same in the case of a biomore, or biomonad, or a cell. The division of a molecule depends upon the orientation of its constituent molecules, and the division of a biomonad, accordingly, is due to the orientation of its constituent biomores. It would lead us too far to attempt to follow the author in his minute analysis of the phenomena of karyokinesis, and it must suffice to quote from the concluding paragraphs of the book : "The property of division, which characterizes living substances, is not due to a special force. It is only the necessary, inevitable consequence of the constitution of this substance and of assimilation." "The force which unites the particles of living matter is the same as that which unites the particles of dead matter and is sufficient for the explanation of the phenomena of division. Division always occurs under the action of this force, whatever may be the constitution of the living substance, and the various figures which appear during division and which characterize cytodieresis are only the morphological consequences of that constitution."

In conclusion, it must be stated that notwithstanding the complexity of the problems discussed and the minute analysis to which they are subjected, the book is written with a rare degree of conciseness and lucidity. Professor Giglio Tos has certainly presented a somewhat abtruse subject in a most interesting manner and has given a new point of view, a working hypothesis which cannot fail to influence future cytological work. The book is suggestive from cover to cover, and the second volume, which is to treat of 'Ontogenesis and its Problems,' will be awaited with interest.

J. P. McM.

A. de Bary's Vorlesungen über Bakterien. Dritte Auflage. Durchgesehen und teilweise neu bearbeitet. Von W. MIGULA. Leipzig, Wilhelm Engelmann. 1901. Mk. 3.60.

The name of DeBary's 'Lectures on Bacteria' still has power to conjure up pleasant memories in those persons who remember when this classic brochure was the only worthy book devoted exclusively to the young science of bacteriology. The ponderous tomes, too often filled with unassimilated facts, that have since appeared in abundance sometimes force us to recall with regret the days when selection of material and skilled exposition were not incompatible with completeness.

The attempt to put new wine into old bottles has always encountered certain experimental difficulties, and it cannot be said that these difficulties have been altogether overcome by Dr. Migula, although something of the charm of the original lectures has been retained. The general arrangement of the sections is the same as in the original edition, while the insertion of new facts and the dropping of outworn creeds is perhaps as skilfully carried out as could be expected. In spite of the defects to be anticipated in a rewritten work of this sort, the lectures will readily command interested readers. It will always be questioned, however, whether the successive changes in the viewpoint of a rapidly growing science do not continuously demand new methods of exposition, and whether it is quite fair to a book that has served well its day and generation to bring it again upon the stage.

E. O. J.

A Laboratory Guide in Elementary Bacteriology. By WILLIAM DODGE FROST, Instructor in Bacteriology, University of Wisconsin. Published by the Author, Madison, Wisconsin, 1901.

The development of bacteriology as a subject of general scientific importance has led in several American universities to the introduction of courses in bacteriology into the regular undergraduate curriculum, and has created a demand for a kind of laboratory training adapted to the requirements both of the college student and of the student of medicine. The book before us outlines a course of this character, elaborated during several years of experience at the University of Wisconsin. The arrangement and choice of matter will be generally commended. The ordinary technical procedures are lucidly described with the aid of many diagrams, and are in thorough accord with the latest and best practice. The book is not distorted by being wrested to special utilitarian ends, but is rather designed to lay a broad foundation for subsequent specialization in any branch of bacteriology. It is admirably fitted for this purpose.

E. O. J.

Elements of Quaternions. By the late SIR W. R. HAMILTON. Second edition. Edited by PROFESSOR C. J. JOLY. London, Longmans & Co. Vol. I., pp. xxxiii + 583; Vol. II., pp. liv + 502; quarto.

The first edition of the 'Elements of Quaternions' consisted of 500 copies; and as many of these were presented to men of science, the book soon became scarce on the market. The published price was one pound; five times that amount has been paid for a single copy. In fact it frequently happened that a student could not obtain a copy of the English edition, and was obliged to content himself with Glan's German translation. Therefore we hail with pleasure a second edition of this classic of the mathematics, especially as it is printed in two handsome quarto volumes, and can be purchased at a moderate price.

Hamilton spent the last seven years of his life in the preparation of the 'Elements,' which he designed to be the *Principia* of space-analysis. He did not live to see them published.