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.

The successive sheets were revised by him and printed off under his direction; but at his death some intended articles remained unwritten, although everything up to them had been revised and printed off. Professor Joly testifies in his preface that he has found extraordinary accuracy both of matter and of printing in the first edition. To the new edition he has added a preface, an index, an analysis of each article in the table of contents, footnotes and an appendix containing more lengthy notes on the following subjects: 'Quaternion Determinants,' 'Miscellaneous Properties of Two Linear Vector Functions,' 'The Strain Function,' 'On the Specification of Linear Vector Functions,' 'On the General Linear Transformation in Space,' 'On the Theory of Screws,' 'On Finite Displacements,' 'On the Kinematical Treatment of Curves,' 'On the Kinematical Treatment of Surfaces,' 'On Systems of Rays,' 'On Hamilton's Operator ∇.'

It was Abel who said that if one wished to make progress in mathematical science he ought to study the original work of the master rather than the presentations of his pupils. This maxim applies especially to quaternions; and for facilitating the study of Hamilton's great work the Printing Board of Trinity College, Dublin, and the editor, Professor Joly, deserve the thanks of the mathematical world.

ALEXANDER MACFARLANE.

SOCIETIES AND ACADEMIES.

THE RESEARCH CLUB OF THE UNIVERSITY OF MICHIGAN.

THE Research Club of the University of Michigan was organized two years ago, its membership being made up from the University Faculties, and its aim being the promotion of research. During the year just closed, the Club has met six times, and its proceedings may be briefly summarized as follows:

At the first meeting, held in October, 1900, the theme for discussion was 'The Promotion of Research at the University of Michigan.' Dr. Vaughan, President of the Club, addressed the members on the organization and objects of the Club, and closed with remarks on the topic of the evening. Professors Wenley, Ziwet, Adams and Reighard spoke by appointment, and they were followed *ex tempore* by Dr. Hulett, Dr. Bigelow and Dr. Dock.

At the second meeting, November, 1900, the speakers were Professors Hempl and Newcombe. Professor Hempl spoke on the formation of dialect districts in the United States, showing with the help of charts the boundaries of various dialectic differences. The speaker gave concrete examples of variation in the use and pronunciation of words and phrases, and made some attempt to trace the historical development of these variations.

Professor Newcombe narrated his experiments on the sensitive curves made by roots in response to the streaming of water, and in response to contact with a foreign body. It was shown that about one-half of the thirty-three species of plants tested are sensitive to the water-current, and that of the four water-plants used, none is sensitive. So far as tested, all those plants responding to the water-current responded to the contact of a foreign body, and those not responding to one did not respond to the other. Hence it is supposed, though not demonstrated, that the response in both cases is response to one-sided pressure. A summary of these results may be found in SCIENCE, XIII. (1901), p. 250.

The third meeting came in January, 1901. Professor Gomberg detailed the experiments which led to his discovery of the trivalency of carbon. Accounts of this work may be found in *Jour. Amer. Chem. Soc.*, **22**, 757; *Ber. d. d. Chem. Gesellsch.*, **33**, 3150; *Amer. Chem. Jour.*, **25**, 317. Dr. H. S. Jennings stated his results in studying the reactions of infusoria to external stimuli, illustrating his summary with experiments, made visible to all present by projection with a lantern. The researches of which Dr. Jennings gave an account have been published in full in various journals, and an abstract appeared in SCIENCE for January 11, 1901 (XIII., 74), in the report of the Zoological Journal Club of the University of Michigan.

The February meeting listened to papers by Dr. George Dock and Professor W. B. Pillsbury. Dr. Dock described the method of teaching internal medicine in the University. The limited time in the medical course makes it