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knowledge of tropical diseases. A discussion followed.

UNIVERSITY AND EDUCATIONAL NEWS.

THE University of London Commission Bill has passed the second reading in the British House of Commons without a division.

CAMBRIDGE UNIVERSITY has received a bequest of £10,000 for the foundation of a scholarship or prizes.

THE Wawepex Society has given \$200 for a scholarship in biology at the Coldspring Laboratory of Biology, to be filled by a graduate student of Columbia University. Mr. F. B. Sumner has received the appointment.

THE chair of botany in the University of Wisconsin, vacant by the removal of Professor Charles R. Barnes to the University of Wisconsin, has been filled by the election of Dr. R. A. Harper, of Lake Forest University.

DR. ALEX. HILL, master of Downing College and an eminent physiologist, has been re-elected Vice-Chancellor of Cambridge University for the ensuing academical year.

MR. R. PENDLEBURY and Mr. A. E. H. Love, F.R.S., fellows and lecturers in St. John's College, have been appointed University lecturers in mathematics.

PRINCIPAL CAIRD will on August 1st retire from the principalship of Glasgow University.

MISS GERTRUDE HALLEY has been appointed one of the demonstrators in anatomy in Melbourne University.

M. P.-M. LABATUT has been given charge of the instruction of physics and chemistry in the medical school of Grenoble.

SCIENTIFIC LITERATURE.

La Mathématique; philosophie, enseignement. Par C.-A. LAISANT, répétiteur à l'école polytechnique, docteur ès sciences. Paris, George Carré et C. Naud. 1898. Pp. 292.

The above work consists of three parts: the philosophy of pure mathematics, the philosophy of applied mathematics, and the teaching of mathematics. The first part is subdivided into the following chapters: Mathematics and its

Divisions, Arithmetic and Arithmology, Algebra, Infinitesimal Calculus, Theory of Functions, Geometry, Analytical Geometry, Rational Mechanics. The second part is divided into General Considerations, Application of the Calculus, Application of Geometry, Application of Mechanics, and the third into General View of the Teaching of Mathematics, Teaching of Arithmetic, Teaching of Algebra and the higher Calculus, Teaching of Geometry, Teaching of Analytical Geometry, Teaching of Mechanics, the Hierarchy of Education.

In an introductory chapter M. Laisant sets forth the aim of the book. He says that he does not write for those who are deeply versed in mathematical science, nor those who are ignorant of it, but for a middle class, namely, those who are studying mathematics or have studied it and whose knowledge and interest are kept alive by teaching it or by being engaged in work requiring its application. It may be said, however, that whatever is written on the philosophy of mathematics by so eminent a master of geometric algebra and distinguished investigator of the hyperbolic functions cannot fail to be of interest to the professional mathematician; and even the mere seeker after culture will find in this volume many things to arouse his interest in the most perfect of all the sciences.

In traversing the domain above described the author discusses many questions of scientific and educational interest; in this notice there is only room to mention a few. One of the first points he makes is that it is not correct to speak of the mathematical sciences, as they all aid one another, give mutual support, and in certain parts blend together; there is but one vast science, which no one can flatter himself to master completely, for its conquests are infinite in nature.

M. Laisant does not pretend to be a professional philosopher, but he has read the works of Leibnitz, Descartes, Pascal, D'Alembert, Diderot, Condorcet, Comte, each of whom was a philosopher, and likewise left a brilliant record in mathematical science; in this volume we have the digested results of his reading and reflection. Work of the character described is the most valuable kind of philosophy, and very rare in these times, for the saying of Leibnitz

is as true now as ever : "Sans les mathématiques ou ne pénétre point au fond de la philosophie ; sans la philosophie on ne pénétre point au fond des mathématiques ; sans les deux, on ne pénétre au fond de rien."

The author bases the plan of the volume on an opposition between pure mathematics and applied mathematics. It is pure mathematics which furnishes us with infallible formulas and deductions ; it is applied mathematics which completes the work by showing the necessary existence of errors. The distinction made is largely that between rational and empirical laws in physics. It is not that the one is independent of experience and the other dependent on it ; for both are based on experience (p. 10). Why the formulas of the one are infallible, while those of the other are not, is not made very clear.

The author is not satisfied with any of the current definitions of mathematics, but prefers to describe it by means of its object. The essential object of all science, according to M. Laisant, is the study of the phenomena presented by the external world ; and the mathematical treatment of these phenomena consists of three stages : forming the equations, solving the equations, interpreting the results.

As regards the importance of mathematical science, the author quotes the saying of Kant : "A natural science is a science only so far as it is mathematical," and that other saying attributed to Napoleon the First : "The advancement and progress of mathematics are bound up with the prosperity of the State." According to M. Laisant it is the most marvelous instrument created by the genius of man to aid in the discovery of the truth.

At page 30 the author takes the ratio or relative view of algebraic quantity and is led to look upon multiplication as the formation of a number (the product) which has to the multiplicand the same ratio as that which the multiplier has to unity. While this may be sufficient for elementary arithmetic, it does not satisfy the calculus of the mathematical physicist, for with him a symbol stands for a magnitude of some kind, not for its ratio to some supposed unit.

The author criticises in vigorous terms the

procedure adopted by some of giving mathematics a definitional or ideal basis. It is marching in the direction opposite to progress, and is a revival of the attitude of the sophist. Algebra is not one, but several, because the properties of the quantities which it treats are different in their nature. Thus the rules of the method of quaternions differ from those of algebra not by arbitrary definition, but because the geometry of space demands it. At another place the author suggests that the method of quaternions when more fully developed is certain to modify and advance the theory of functions.

The author says that the fundamental error of the ancient geometers was that they did not recognize the experimental element which is at the base of geometry ; when it is recognized, the non-Euclidean geometry becomes a logical possibility.

What is said on the teaching of mathematics refers to France, but much of it is valid everywhere. In the domain of primary mathematics the pupil ought to be interested, encouraged to make research, be given the feeling—the illusion, if you will—that he is discovering for himself what he is being taught. This demands in the first place a teacher of a high order, and in the second place that the class be small and homogeneous. When the class become a flock and the teacher a shepherd's dog, no progress is possible. The fundamental principles ought to be singled out and exhibited in all their relations, and their meaning made clear by frequent applications. Memory ought to play a very subordinate part ; it is the understanding which ought to be exercised. In the domain of the more advanced instruction he does not favor the study of a text-book, still less dictated lessons. He recommends notes taken by the pupil of oral lessons. In the highest domain he recommends the taking of notes, supplemented by a text-book.

For the first introduction to arithmetic he recommends a rigorously experimental method ; to have the child to make his own notions in the presence of realities which he can touch and see, to demonstrate nothing, and to make the instruction have the appearance of play rather than of work. In this way a firm

foundation is laid for the teaching of the principles and rules.

In the teaching of algebra he would make plain the theory of imaginaries, when the extraction of the square root comes up; and would introduce an exposition of geometric quantity before taking up the equation of the second degree. He predicts that the day when the geometric calculus will be introduced in the regular course of instruction is not far off. In the concluding chapter he deplors the too great centralization of mathematics in Paris to the injury of the rest of France.

In conclusion we recommend the volume to the notice of every live mathematician, and to every one interested in the nature of human knowledge.

ALEXANDER MACFARLANE.

Elements of Comparative Zoology. By J. S. KINGSLEY, S.D., Professor of Zoology in Tufts College. New York, Henry Holt & Co. 1897.

This book of 357 pages embodies an attempt to combine the text-book proper with the laboratory manual in such proportions as to meet the demand of the beginner. It is contended in the preface that "a knowledge of isolated facts, no matter how extensive, is of little value in education, excepting as the powers of observation are trained in ascertaining those facts." In accordance with this idea, the author lays stress upon the more obvious features of the types considered, and seeks to lead the student to an intelligent appreciation of the significance of those features in studies under the title of 'Comparisons.' For example, a bony and a cartilaginous fish are studied separately, and then the facts acquired by the student are correlated by a series of questions which require a careful comparison. In this way twenty-five types are studied and compared, the types representing all the main divisions of the animal kingdom, and being chosen from the most readily accessible materials.

The text of the work is based upon the systematic relations and discusses the orders seriatim.

There is one detail of arrangement, however, which will not appear to everybody to be entirely happy. In the discussion of the fishes

the Selachii and Teleosts are treated at some length, and then follows the part bearing upon Pisces. When one comes to the sub-classes he is referred back to Selachii and Teleosts. This may prove somewhat confusing, although the motive is evidently to emphasize the groups of which types have been studied.

There are numerous illustrations and diagrams, the latter in many cases being particularly suggestive.

The part devoted to the laboratory work is arranged in the form of simple directions for dissection and questions to lead the student to as independent a method as possible. The criticism that will be forthcoming will be that the laboratory work is meager—that students, even in the high school, frequently want to know more than the laboratory guide leads them to. This, however, is a minor criticism, since the teacher, if up to the mark, can supplement the work according to his judgment.

The introduction contains suggestions in regard to the carrying on of laboratory work; apparatus, which is reduced to a minimum as to both quantity and simplicity; materials for dissection, and reference books.

The whole is a small, handy volume, neatly bound and well printed on good paper.

F. E. LLOYD.

The Phytogeography of Nebraska. 1. General Survey, by ROSCOE POUND, Ph.D., Director of the Botanical Survey of Nebraska, and FREDERIC E. CLEMENTS, A.M., Assistant Instructor in Botany in the University of Nebraska. Lincoln, Neb. 1898. 8vo., 329 pp., with four maps. Presented by the authors to the Faculty of the University of Nebraska as a thesis for the degree of Doctor of Philosophy.

From the preface we learn that this work is the result of nearly five years of active study of the floral covering of Nebraska, carried on by the members of the Botanical Seminar in the Botanical Survey of the State. The systematic study of the vegetation of Nebraska was begun by Dr. Bessey in 1884, and has since been carried on by him and his students, all previous collecting having been more or less desultory and unreliable. The Botanical Survey was or-