been elected full professor of zoology in the Scientific School.

THE following promotions have been made in the department of zoology at the University of California: Associate Professor S. J. Holmes to a professorship; Assistant Professors J. F. Daniel and Joseph Grinnell to associate professorships.

DR. GEORGE R. WELLS, associate professor of psychology in Oberlin College, has been appointed to a new professorship in psychology in the Ohio Wesleyan University, and will assume his duties in September. A psychological laboratory, housed in a separate building, has been provided and is being equipped at the latter institution.

M. P. MARIE, professor of pathologic anatomy at the University of Paris, has been appointed to the chair of diseases of the nervous system, to succeed the late Professor Dejerine. M. Letulle, hitherto professor of the history of medicine, has been given the chair of pathologic anatomy.

DISCUSSION AND CORRESPONDENCE

WANT OF ADAPTATION TO THE TIME OF THE PRINTING PRESS

IF the printing press is recognized as the most important instrument for the diffusion of knowledge, the advancement of science requires that it should be used with a precision like that shown in the use of the microscope or in the application of statistical methods.

It seems that this want of adaptation is shown in lack of adequate provision for, and in the common method of, the publication of scientific literature. Gifts to local establishments, in spite of their great value, seem silly compared with a proper endowment for the publication and distribution of scientific separates.

All scientific articles should be printed and sold separately, so that a student could subscribe for the literature of a certain subject. This would not prevent any one from binding together any papers he wished. Scientific publication is in a bad way, if it must be provided for by requiring one to pay for matter one does not need, and which, as far as one is concerned, is not worth shelf room. I am interested in literature relating to certain bees, but that does not incline me to pay for descriptions of Sarcophagidæ which take up eight pages for one species. In the library of the Missouri Botanical Garden I could not find papers by one author because the transactions in which they were printed did not contain enough botanical literature to justify purchase by that institution.

A magazine publishing transient articles is good enough, but one publishing important contributions to science in a various mixture is more or less of a burial place for such literature, whether one considers the persons the authors are trying to reach or those desiring to see the articles. That his writings should reach every one who is interested in them, or would profit by them, is as important for an author as it is for the student to see the writings in which he is interested—and the interests of both are in line with the advancement of science.

That the publishing of heterogeneous articles in journals is objectionable is shown by the practise of printing author's separates. But these are usually unsatisfactorily distributed and soon exhausted. The printing of separates operates against the interests of the journal when a writer avoids subscribing for it on the expectation of receiving the separates from their authors. For the sake of students a discriminative author may be inclined to publish all of his papers on a given subject in the same journal, but the journal may prefer a variety of papers in order to increase its subscription list. So, also, a paper which has some body to it is broken into monthly parts to make room for articles on different subjects. It is a question whether the magazines do not encourage fragmentary and desultory methods of investigation and publication.

On account of objection to too many, or too long, papers on the same subject, or simply inadequate provisions for publication, descriptions of American insects are often published in foreign journals—a practise clearly opposed to the interests of science. However, some au-

thors seem to have a mania for scattering literary fragments and may cultivate foreign journals merely for the sake of personal advertising.

Entomological News, 28: 141, after mentioning four journals which lasted an average of five years each, says:

> In general it seems that the number of specialists in any one or two orders of insects is not sufficient to support a special journal, and we know of none such provided with an endowment fund guaranteeing its permanency. In this matter we must still be entomologists, apparently, and yet the record of general entomological journals contains many a short-lived periodical.

The significant point here is that, while we are specialists as regards the literature we desire, we are general entomologists as regards the literature we have to pay for.

As educational institutions the university is local, while the printing press is cosmopolitan, the only cosmopolitan university. The publication of scientific literature should not be supported by requiring specialists to pay for literature they do not need, any more than the university should depend for its entire support upon the tuition of its students.

Charles Robertson

Carlinville, Illinois

Fundamental Conceptions of Modern Mathematics

To the Editor of Science: In your issue of August 4, there appeared a review of the first part of our "Fundamental Conceptions of Modern Mathematics," from the pen of Professor G. A. Miller. Against a hostile criticism, giving a portrayal of at least some of the main theses of our book and attempting to controvert them, we would have no inclination to protest. But all the important issues raised by our treatise are ignored by Professor Miller, who dwells upon features having no bearing upon any of the arguments of our work, or upon any of the doctrines which it is the purpose of the arguments to uphold.

Surely a reviewer can be justly expected to take up at least one or two of the principal doctrines of a treatise of which he disapproves, and show that these doctrines are erroneous. Our book contains an account of quantities and their classification; an investigation into what the symbols used by mathematicians really stand for. We set forth the classification of quantities into what we call sorts, kinds and varieties, and show the importance of this classification in the subdivision (originally conceived by De Morgan) of algebraic science into single algebra, double algebra, etc. A precise statement is given of what we apprehend to be the nature of the quantities dealt with in quaternions and other systems of vector analysis, and of their relation to the quantities of ordinary algebra. We attempt to show that any really scientific treatment of ordinary imaginary quantities must be based on vector analysis, all imaginary and complex abstract quantities (save those of zero value) being, in fact, relations between vectors. This is, we hold, the only way to ascend, from a blind use of imaginary and complex expressions without any clear apprehension of what they denote, to a rational comprehension of the matter; in other words, from mere computation, and manipulation of symbols, to true science. We show further that the mathematicians who look upon a variable as a quantity and those who regard it as a symbol are equally in the wrong; a variable being represented by a symbol and being composed of quantities. We consider the arrangement of the quantities of a variable, and show the importance of this commonly neglected attribute. We discuss the peculiar arrangements which must be at hand to justify the application of the theory of monogenic functions, and show the relation of these multiplex arrangements (as we call them) to the arrangements of the elements of the aggregates designated by Cantor as *mehrfach geordnet*. As the simplest of variables we put forward the ordinary progressions of elementary mathematics which are not usually recognized as variables at all. We attempt to show clearly just what distinctions should be drawn between a progression and a series; and, including all progressions and all series under the head of sequences, lay down the conditions under which a variable is to be