

*A Laboratory Guide in Elementary Bacteriology.* By Dr. William Dodge Frost. Third revised edition. Pp. xiii+395. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1903.) Price 7s. net.

This book is, as stated in the title, a guide for practical laboratory work in elementary bacteriology. The student is taken step by step through the various processes of cleaning and setting up apparatus, sterilisation, preparation of culture media, demonstration of gas production, and detection of certain chemical products, the result of microbial activity. The isolation and cultivation of bacteria, and staining methods, are then considered, and a few exercises are given on the physiological properties of micro-organisms, such, for example, as the influence of the reaction of the medium on growth, the effects of desiccation, &c. The student is next introduced to the systematic study of types, first of non-pathogenic and then of the chief pathogenic forms. In this, as well as in the preceding portions of the book, a heading only is given, and to the exercises and practical work, and pages are left blank for the student's own notes, subheadings indicating what he should observe and look for, the facts observed being entered up by the student himself. In addition, outline diagrams are given of culture tubes which are to be filled in with the students' own drawings. In this way the guide becomes a permanent note-book and record of the student's work. Finally, directions are given for the inoculation and *post-mortem* examination of animals, and a key index of the characters of the more important species concludes the volume. At the end of each section a reference is given to the principal manuals and text-books of bacteriology, such as Abbott's, Chester's, Eyre's, Hewlett's, Muir and Ritchie's, Sternberg's, &c., so that the student may read up the subject. So far as we have been able to observe, the directions given are clear and concise, the exercises judiciously chosen, and the book is singularly free from errors. That a third edition should have been called for is sufficient evidence of the need for such a book, and for those who desire and work from a laboratory guide, and to lighten the labour of full and complete note taking, it may be strongly recommended.

R. T. HEWLETT.

*Nature-study Lessons for Primary Grades.* By L. B. McMurry. Pp. xi+191. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1905.) Price 2s. 6d. net.

DR. C. A. McMURRY, who has written the introduction to this volume, is one of the chief recognised authorities in America on elementary scientific education, and, indeed, on elementary education in general, and since he has probably read the proofs and given a general approval to the text, the work may be regarded as being written by one having authority. The plan of the work is to take a series of animals and plants and to show how the lessons to be learnt from them may be taught to pupils of tender years, or rather how the pupils may be trained to find out the meaning of the lessons for themselves. Having gained the confidence and attracted the interest of the pupils, the first object of the teacher should be to endeavour to foster and develop their own powers of observation and of drawing simple conclusions from such observations; and for this purpose the method adopted in the volume seems admirably adapted. Although it is not expected that all teachers will select the same objects for their texts, or that they should all follow by any means the same method of instructing, there can be no doubt of the advantage of having a list of those objects which appear most suitable for the purpose,

and also of the benefits which younger teachers may derive from a perusal of the manner in which a more experienced member of their body handles her subject.

While the book appears admirably adapted for its purpose so far as teaching in America is concerned, it seems to require a word of warning when put into the hands of British teachers, and we think it would have been well had a special note to this effect been inserted in the copies intended for sale in this country. For instance, the teaching suggested in the chapter headed "The Robin" will apply for the most part excellently well to the bird so designated in this country; but when the inexperienced teacher (who is unaware that the so-called American robin is not our own familiar red-breast) reads that robins lay blue eggs he, or she, will be apt to put the book aside with the remark that the author does not know her subject. Again, it would much have simplified matters had the English teacher been informed that the plants known in America as "Morning-Glory" include the one commonly called *Convolvulus major* in this country.

With these limitations (which refer only to its issue in this country), we have nothing but praise to bestow upon Dr. and Mrs. McMurry's efforts to establish elementary biological teaching upon a sensible and practical basis.

R. L.

*Einführung in die Vektoranalysis mit Anwendungen auf die mathematische Physik.* By Dr. Richard Gans. Pp. ix+226. (Leipzig: Teubner, 1905.) Price 8 marks.

THIS well-written book gives the usual definitions of scalar and vector products, introduces the now familiar differential operators "div" and "rot" (or "curl"), and uses them skilfully in the simpler applications of the line, surface, and volume integrals, associated with the names of Green, Gauss, and Stokes. The necessity for vector analysis in electromagnetic work is becoming more generally recognised, and Dr. Gans deserves the thanks of all for his able presentation of the outlines of the method which, nevertheless, is at its best a "Quaternionenstenographie," as C. Neumann felicitously nicknames it. One has only to compare the demonstrations here given, which are primarily Cartesian and are then transformed into the concise vector notation, with corresponding quaternion demonstrations, such as may be found in Joly's "Manual," to see plainly the analytical gulf which separates Hamilton's *calculus* from other vector analyses, which are essentially shorthand *notations*. The mathematical historian of the future will find much food for thought in the mental shortsightedness of many vector analysts who delight in the use of contraction symbols like *grad*, *rot*, *div*, but despise the Hamiltonian selective symbols  $\nabla$  and  $S$ , which with the real  $\nabla$  give the whole theory in exquisite compactness and flexibility. On a folding sheet at the end Dr. Gans gives a table of eighteen transformation formulæ, which presumably must all be learned off by rote. There does not seem to be any resemblance among the formulæ ( $h$ ), ( $o$ ), ( $q$ ), which give respectively the equivalents of  $[A[BC]]$ ,  $\text{rot rot } A$ ,  $\text{rot } [AB]$ . In the quaternion notation  $\nabla \nabla BC$ ,  $\nabla \nabla \nabla A$ ,  $\nabla \nabla \nabla AB$ , they are seen to be of the same "form," and are, indeed, analytically amenable to the same treatment. This is but one illustration of the inferiority of the "Quaternionenstenographie" to the real quaternion analysis. Dr. Gans gives interesting applications in hydrodynamics and in Maxwell's electromagnetic theory, but is limited somewhat by the fact that in this introduction there is no account taken of the linear vector function or matrix.