ment. He possessed great skill in the planning of apparatus and methods and remarkable judgment as to the processes best suited either for purposes of instruction or for the securing of accurate scientific results. To the development of the Laboratory of Electrical Measurements in the Massachusetts Institute of Technology he gave for years his best endeavors, and to him is due the success of its work. He was also placed in charge of the newly instituted Laboratory of Heat Measurements, and though prevented by failing health from developing this as he would have chosen, he laid a solid foundation for those coming after him.

Professor Holman was born a teacher, and never grew weary in his profession. His personal relations with his pupils were very intimate. By that example which is better than the wisest precept, he impressed upon them the preeminent necessity of thoroughness, accuracy and honesty in all the work which they might be called upon to perform, either as students or in professional life. He is remembered by them with the most affectionate regard.

Reference has already been made to the interference of ill-health with the prosecution of the labors of Professor Holman. In fact, after reaching manhood he was never in good health, and during almost the whole of his active life as a teacher he struggled with a painful chronic disease, which gradually, though with some intermissions, sapped his strength. His cheerful disposition and persistence in carrying on his work were such that none but those who knew him well were aware of the fact that it was only his indomitable courage which prevented him from yielding to his malady for some years before it finally overcame him. In the spring of 1890 he was obliged to discontinue work for a time. He spent the following year abroad and came home much improved in health; but the relief was only temporary. In 1895 he finally gave up his work of instruction. For some years after this, however, though confined to his chair and at last even deprived of his sight, he continued to labor diligently and published the tables of logarithms and the work on matter and energy mentioned above. His latest years were his best ones, and his whole life was a fine illustration of the manner in which a noble spirit may rise superior to circumstances and produce the best results under conditions to which an ordinary mind would utterly succumb.

CHAS. R. CROSS.

SCIENTIFIC BOOKS.

Botany—An Elementary Text for Schools. By L. H. BAILEY. New York, The Macmillan Company. 1901. 8vo. Pp. xvi + 356. Price, $1.10.

Foundations of Botany. By JOSEPH Y. BERGEN, A.M. Instructor in Biology, English High School, Boston. Boston, U. S. A., Ginn & Company. 1901. 8vo. Pp. xii + 412 + 258. Price, $1.50.

Within the past three or four months two notable text-books on high-school botany have appeared, the one from the ready pen of Professor Bailey, of Cornell University, to whom we are already indebted for so many helpful and suggestive books on various phases of plant life, the other from Instructor Bergen, of one of the Boston High Schools, who also has the distinction of having written acceptably in the preparation of an earlier, very useful, although much simpler, text-book for high-school students.

The two books are quite different in both content and mode of treatment. Professor Bailey takes the quite extreme position that 'the schools and teachers are not ready for the text-book which presents the subject from the viewpoint of botanical science,' and is particularly opposed to the use of the compound microscope in high schools, as when he says: "The pupil should come to the study of plants and animals with little more than his natural

and native powers. Study with the compound microscope is a specialization to be made when the pupil has had experience, and when his judgment and sense of relationship are trained." A little later he says: "It is often said that the high-school pupil should begin the study of botany with the lowest and simplest forms of life. This is wrong. The microscope is not an introduction to nature." We do not quite like the tone of non-approval in regard to science and specialists which is heard now and then in the author's preface, as in the first sentence quoted, where botanical science is referred to, and in this, "A book may be ideal from the specialist's point of view, and yet be of little use to the pupil and the school," and, "Every statement in an elementary text-book has two values—the teaching value and the scientific value," and, again, "Education should train persons to live, rather than to be scientists," and still, again, "Expert specialists are so likely to go into mere details and to pursue particular subjects so far, when teaching beginners, as to miss the leading and emphatic points." There is already too much of this feeling abroad in the land, as witness the recent discussions in Congress on matters of scientific importance, and there is no call for any one to increase it by discrediting any department of science or those who have devoted their lives to scientific work. Of course, we know that the author does not wish to be understood in this way, but his wording is unfortunate and will certainly be so understood by many people.

It would be unfair to quote the foregoing sentences, with the wording of which at least we most emphatically do not agree, and refrain from some quotation of those in regard to which there will be no question, as for example, "In the secondary schools botany should be taught for the purpose of bringing the pupil closer to the things with which he lives, of widening his horizon, of intensifying his hold on life," and, "Botany always should be taught by the 'laboratory method': that is, the pupil should work out the subjects directly from the specimens themselves."

The book is divided into four parts under the titles of 'The Plant Itself,' of 195 pages; 'The Plant in its Environment,' of 37 pages; 'Histology, or the Minute Structure of Plants,' of 42 pages, and 'The Kinds of Plants,' of 66 pages. The first is almost entirely devoted to the gross anatomy and elementary physiology of seed plants, but 24 pages being given to the structure of algæ, fungi, lichens, liverworts, mosses, ferns, horsetails and quillworts. The second part is ecological in a very elementary way, the treatment being well adapted to the needs of the pupils for which the book is designed. The third part, on the contrary, is quite severely technical, in spite of the author's prefatory remarks about the compound microscope, including such technical matters as fixing, imbedding, sectioning with the microtome, staining and mounting, and even not excluding karyokinesis! Part IV. consists of a handy little manual about 300 selected species of ferns and seed plants. Throughout the book the illustrations, of which there are 500, are very pretty, many of them being 'half-tone' reproductions of photographs.

We distinctly do not like the lists of questions at the close of the chapters, each question matching an italic or heavy-type sentence in the text. These will certainly lead to grave abuses. On the other hand, there is much to commend in the book. It is charmingly written by one who knows a great deal about plants, and who is desirous of having the young people know plants as he knows them. His enthusiasm will inspire many a pupil to take up the serious study of plants who otherwise might have passed them by had the subject been presented in a different way, especially where the teacher has little knowledge of botany.

In Instructor Bergen's book we have less divergence from the generally accepted principles in secondary botanical teaching. The author 'has attempted to steer a middle course between the advocates of the out-of-door school and of the histological school of botany-teaching.' That he is not afraid of the scientific or technical aspects of botany is shown by the following quotations:—"The latest authorities in the various departments of botany have been consulted on all doubtful points, and the attempt has been to make the book scientifically accurate throughout, yet not unduly difficult."

* * * "The author has no sympathy with those who decry the use of apparatus in botany teaching in secondary schools and who would confine the work of their pupils mainly within the limits of what can be seen with the unaided eye. If the compound microscope plainly reveals things shown only imperfectly by a magnifier and not at all with the naked eye, use the microscope. If iodine solution or other easily prepared reagents make evident the existence of structures or substances not to be detected without them, then use the reagents." * * * "When the university professor tells the teacher that he ought not to employ the ordinary appliances of elementary biological investigation in the school laboratory because the pupils cannot intelligently use them, the teacher is forced to reply that the professor himself cannot intelligently discuss a subject of which he has no personal knowledge." It is evident from the foregoing that the two authors approach the task of outlining the work for the pupil in the secondary schools with very different ideas as to what may be and should be done.

The book contains three parts, viz., 'Structure, Function and Classification of Plants,' 'Ecology, or Relations of Plants to the World about Them,' 'Key and Flora.' The first part begins with the seed and its germination, followed by chapters on the movements, development and morphology of the seedling, roots, stems, buds, leaves, flowers and fruits. In all this there are many physiological experiments, as well as much work with the compound microscope, one short chapter on protoplasm and its properties being interpolated. We have illustrated here, also, the usual exaggerated emphasis too commonly given to the flowering plants, which have 235 pages given to them as against but 63 pages for the slime moulds, bacteria, fresh-water and marine algæ, fungi, lichens, bryophytes, ferns and their allies. The second part is ecological, and follows the usual German treatment of this subject. It contains much interesting information, and pretty and suggestive pictures, but we do not look for much scientific training from the pupil's study of these chapters. At best the pupil will obtain but a very general and vague notion of the many things referred to here. Some serious errors mar this portion of the book, as in the treatment of 'plant formations' and 'prairies' on page 310.

The 'Flora' is much like most other manuals for beginners, which are made easy by the device of omitting certain families, which among teachers are reputed to be quite too difficult for the young student. It includes seed plants only.

CHARLES E. BESSEY.

THE UNIVERSITY OF NEBRASKA.

Text-Book of the Embryology of Invertebrates. By DR. E. KORSCHELT and DR. K. HEIDER. Translated from the German by MATILDA BERNARD. Revised and edited with additional notes by MARTIN F. WOODWARD. Vol. IV., Amphineura Lamellibranchia, Solenoconcha, Gastropoda Cephalopoda, Tunicata, Cephalochorda. London, Swan, Sonnenschein & Co., Ltd.; New York, The Macmillan Co. 1900. 18s.

This is the concluding volume of the somewhat tardy translation of Korschelt and Heider's standard 'Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere' 1893. As the editor notes in the preface, invertebrate embryology has made immense advances during the last eight years; thus a mere translation of the thorough and scholarly German work would fail to give an adequate account of the present state of knowledge. The translation itself by Matilda Bernard is a very faithful rendering into good English of the original. But the separation of the offices of translator and editor has necessarily limited the revision largely to numerous footnotes and some interpolations. This has the decided defect of preserving conspicuously all that later researches have shown to be errors in the original German edition, and of relegating the corrections to subordinate paragraphs or footnotes in small type easily overlooked by the average student. Thus, to take but a single example, the account of the cleavage of the lamellibranch ovum in the original has been shown to be incorrect, and it is illustrated by diagrams that faithfully and forcibly confirm the error. Yet both are given literally in the translation, and it would re-