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SCIENTIFIC BOOKS.

RECENT BOOKS ON PHYSICS.

Natural Philosophy for General Readers and Young People. Translated from Ganot's 'Cours élémentaire de physique,' by E. ATKINSON. Ninth edition, revised by A. W. REINHOLD. Longmans, Green & Co. 1900. Pp. 752.

Elements of Physics. By C. HANFORD HENDERSON and JOHN F. WOODHULL. D. Appleton & Co. 1900. Pp. 388.

A Brief Course in General Physics. By GEORGE A. HOADLEY. American Book Company. 1900. Pp. 463.

One Thousand Problems in Physics. By WILLIAM H. SNYDER and IRVING O. PALMER. Ginn & Co. 1900. Pp. 142.

A Manual of Laboratory Physics. By H. M. TORY and F. H. PITCHER. John Wiley & Sons. 1901. Pp. 288.

Advanced Exercises in Practical Physics. By ARTHUR SCHUSTER and CHARLES H. LEES. England, Cambridge University Press; New York, The Macmillan Company. 1901. Pp. 368.

It was in 1863 that Dr. Atkinson first put before English readers his excellent translation of Ganot's 'Éléments de Physique,' a book which quickly won favor by its good arrangement and lucidity. In the first edition he graciously apologized for the use of the metric system. It has passed through fifteen or more editions since its introduction. A demand soon arose for the more elementary course by the same French author, as a text-book for the middle and upper classes of schools preparatory to college. The popularity of this is manifested by the appearance now of its ninth edition, a considerable part of which had been prepared for the press before the death of Dr. Atkinson. The present volume has all the excellences of its predecessors, the illustrations being abundant, and some of them possibly a trifle too expensive. Colored lithographs of metallic spectra and of Geissler tube discharges were formerly fashionable, but in a general treatise to-day they seem almost out of date. For the general reader it would be hard to find a more pleasant and satisfactory book than this volume. For American school purposes, however, it is too diffuse; and it seems adapted only for recitational purposes where oral answers are given to questions relating to descriptive details and general principles. Physics is nothing if not a quantitative science. This idea is best instilled into the elementary student, even though his mathematical attainments be not sufficient to warrant the use of complex problems.

The present volume illustrates the difficulty of maintaining a text-book up to date by slight modifications and additions applied in succession to a long series of new editions. As years pass on, the necessity for omissions becomes as

important as for additions. On page 207 a paragraph about the audiphone states that "not merely deaf people, but even those who are deaf *and dumb*, can hear musical sounds and *even speech*." The amiable admission implied in what the present writer italicizes is evidently due to the acceptance of a Chicago advertisement. On page 370, in discussing the mechanical equivalent of heat, the name of Rowland has been forgotten by the reviser. A few wood cuts might have been omitted, such as that (page 27) in which the source of the wind that propels a sail-boat is a cherub face nestled among the clouds, its cheeks distended to the bursting point.

The 'Twentieth Century Text-book,' by Henderson and Woodhull, is decidedly more modern, and is comparable with Ganot in the abundance and attractiveness of the illustrations. An appeal is made to the student's human sympathies by the introduction of portraits, with short life sketches, of men whose researches have enlarged the domain of physics, such as Newton, Franklin, Tyndall, Faraday and Lord Kelvin. To this list is added Mozart, naturally in the chapter on music. A comparison of this chapter with those on heat and electricity indicates plainly, without reference to the title page, that the book has been prepared by two men of quite different tastes and aptitudes. The introductory chapters and those on sound and music indicate a writer whose fondness for metaphysics and æsthetics is quite equal to his appreciation of physics. A prosaic student, after studying through the first chapter, is stimulated by such problems as these:

1. "Select five events and analyze them into their matter and motion content."

2. "If a monkey sit on the top of a pole, and always face a man who walks around the pole, with his face always turned toward the monkey, can the man be said to walk around the monkey?"

The mathematical solution of the second problem is easy. Teachers may differ about the metaphysical solution. In the chapter on music are introduced themes from Beethoven, Schumann and Palestrina, in musical notation, as illustrations of melody, harmony and counterpoint, respectively. The authors in their preface give the opinion that "laboratory exercises, questions and problems given in a text-book are manifestly inadequate and unsatisfactory." This expresses quite a reaction from the popular tendency manifested some years ago, especially in the text-books by Gage and Avery. Many will sympathize with them in thinking that the laboratory guide book and the class text-book should be kept separate. Printed questions are often less valuable than those formulated for the occasion by an experienced teacher. It is not so obvious, however, that problems should be excluded; indeed there are probably few teachers of physics who would agree with the present authors on this point. In fact the first part of the book includes several dozen problems and experiments, a few of which are not very well selected. The general style, selection of material and mode of treatment are, however, good, and the book will probably be popular, particularly on account of the emphasis given to the relations of physics on all sides to human life and the interests of educated people.

The leading idea in Hoadley's text-book is to insure the coordination of reliability in the text, class demonstrations of stated laws, practical questions and problems on the application of these laws, and personal experimentation in the laboratory. The volume is a combination of text-book and laboratory manual intended to cover the work of a scholastic year in the high school. If it be admitted that two small separate volumes should be so combined—and every teacher has a perfect right to judge for himself about this—the work done by the author is exceedingly good. Considerable labor, it is true, will be required of the teacher who uses this book for the first time, and therefore has to secure the construction of the special apparatus for which the laboratory exercises are adjusted. But these exercises are well selected and well described. The practical questions and problems are numerous, and every page indicates that the author is methodical, careful and well informed regarding the needs and limitations of the class of students for whom he writes. He does not shun algebraic formulas or 'dodge' any real difficulties. Some formulas are given,

without deduction, as statements of physical laws. For elementary students this is often necessary, and the mathematical formulation is quite as desirable as verbal expression. Statements of fact are so generally accurate that the author can afford to be reminded of an error on page 188, where he has defined 'discord' more sharply than the facts warrant, by failure to recognize Mayer's law, which expresses the duration of the residual auditory sensation as a function of vibration frequency, the equation being expressible in a curve which Professor Mayer published in 1894 (*Am. Jour. Sci.*, Jan., 1894). In the chapter on electricity a very clear elementary discussion is given of such recent developments as the Wehnelt interrupter, self-regulating vacuum tubes, and wireless telegraphy. The book is abundantly worthy of commendation.

Snyder and Palmer's little volume on 'Problems in Physics' is a good collection intended for use in secondary schools, every problem having borne already the test of class use. For the convenience of overworked teachers it seems very desirable that a collection of answers should be published. Any competent teacher can work out all these problems for himself; but in the majority of cases it is only necessary that the pupil should work out such as have been assigned him. The teacher may assume the labor of verification wherever this may seem desirable, but he should not be subjected to unnecessary burdens.

Tory and Pitcher's 'Manual of Laboratory Physics' constitutes the course of elementary physics given in the laboratory of McGill University, Montreal. For each experiment there is a list of references, a list of apparatus, a short statement of the theory involved, practical directions, and a tabulated example. The arrangement is excellent, and the deductions of formulæ under the head of 'Theory of Experiment' constitute a good review of principles which the student is supposed to have mastered before entering the laboratory. Like all manuals of this kind, the book is a collection of the separate manuscripts prepared by the authors, while they were associated together as demonstrators in the physical laboratory of McGill University.

The manual by Schuster and Lees covers much the same ground as that of Tory and Pitcher, but the instructions given are more discursive and the book is not so well methodized. For somewhat advanced students, who are not so dependent as the beginner is apt to be on the oral guidance of an instructor, the book will be found very valuable. The authors have not aimed at completeness, 'being convinced that a student learns more by carefully working through a few selected and typical exercises, than by hurrying through a large number, which are often but slight modifications of each other.' They attach great importance to neat and accurate work, recorded in good form. The introductory chapter includes a satisfactory discussion of errors of observation.

The acceptability of a new book depends jointly on the author and the publisher. On opening it the reader expects to be able to consult any page without doing roughly by hand what the publisher ought to have done neatly by machinery. The manual just noticed is mechanically unsatisfactory, because the publishers have been guilty of the unreasonable slovenliness of issuing it with edges untrimmed. This fault is bad enough in the case of a magazine, where the insufficient excuse is to make allowance for future binding; but in the case of a book already bound it is inexcusable. American publishers have for the most part risen superior to such a senseless fad; but in England it seems still to hold sway. The present volume of 368 pages is most readily commended to any one who is willing to cut its leaves, to submit to the inconvenience of frayed edges, and to endure the untidiness of such edges after the book has been in use for some time in the laboratory.

W. LECONTE STEVENS.

Lehrbuch der vergleichenden Anatomie der wirbellosen Thiere. Von ARNOLD LANG. Zweite umgearbeitete Auflage. Zweite Lieferung. Protozoa, vollständig neu bearbeitet von Arnold Lang. Jena, G. Fischer, 1901. Mk. 10.

That this account of the Protozoa in the second edition of Lang's well-known 'Lehrbuch' is practically a new work is at once evident on

comparing the number of pages it contains with the number devoted to the Protozoa in the first edition of the same work. In the first edition 22 pages with 21 figures were given to this group; here we have 311 pages with 259 figures. The account of the Protozoa has thus been expanded until it occupies more space than was devoted in the first edition to the Protozoa, Porifera, Cnidaria, Plathelminthes and Vermes all together.

This increase in size gives opportunity for a most valuable résumé of the recent investigations among unicellular animals. Research has been exceedingly active among the Protozoa in the last decade, and a connected, well-digested summing up of the results of this and previous work, such as we have here, is most welcome. In the first edition of the 'Lehrbuch' all direct reference by name to the various investigators to whom the work was due was excluded from the text. In this edition Professor Lang wisely gives up this practice, so that the book serves likewise as a valuable introduction to the recent literature and history of the subject.

In plan of treatment there is much similarity to that of the first edition, though with some modifications. Most important of these is perhaps the preliminary monographic treatment (after the systematic outline) of three typical protozoa—a simple rhizopod, *Amœba* (pp. 35–47); a complicated radiolarian, *Cœlospathis ancorata* (pp. 47–55), and a ciliate infusorian, *Paramecium caudatum* (pp. 55–79). Besides an extended account of the structure, much attention is devoted here to the recent physiological work on these organisms, especially to their movements and reactions. The criticism may be made that the relation of the movements and method of reaction in the infusoria to the form and structure of the organisms is not brought out, although this appears to be the central point in the recent work on this subject.

In the remainder of the work the plan is followed of treating special topics throughout the entire group of Protozoa. Thus, we have chapters on the Protoplasm, the Pellicle, the Nucleus, the Centrosome, Protective Organs, Organs of Movement, Organs of Nutrition, Respiratory and Excretory Organs, Sense Organs, Reproduction, etc. The treatment is usually satisfactory, and is comparatively full. Thus, in the first edition the Organs of Nutrition are disposed of in a paragraph, while here twenty-five pages are devoted to the subject. Especially full and valuable is the account of the reproductive processes, which occupies nearly half of the text. Here the recent work of Schaudinn and others on the most varied members of the group is reviewed. The prominence of the Sporozoa is throughout noticeable, as compared with any previous general account of the Protozoa. Mention may be made of the especially full accounts of the reproduction and alternation of generations in *Trichosphærium* (Schaudinn), *Coccidium* (Schaudinn), the malaria parasite (pp. 229–239), and the Volvocidæ.

The text is clearly written, in an attractive style, and is well illustrated. Exception may perhaps be taken to the large figure of Paramœcium on page 56, which shows an unnatural shape, deformed by pressure, and is so coarsely drawn as to be misleading.

The book forms an essentially independent work on the Protozoa, and is furnished with extensive literature lists, a table of contents, a table indicating references in the text to organisms usually studied in laboratory courses, an alphabetical list of figures and a full index. It will be found valuable to every one interested in this fundamental group of animals.

H. S. Jennings.

Morphology of Spermatophytes. By John M. Coulter, Ph.D., Head of the Department of Botany in the University of Chicago, and Charles J. Chamberlain, Ph.D., Instructor in Botany in the University of Chicago. New York, D. Appleton and Company. 1901. Octavo. Pp. x + 188.

Methods in Plant Histology. By Charles J. Chamberlain, Ph.D., Instructor in the University of Chicago. Chicago, The University of Chicago Press. 1901. Octavo. Pp. viii + 160.

It speaks well for the intellectual activity of the corps of botanists in an American university that these two books, whose preparation must have involved a great deal of labor, have appeared within the past three or four

months. This is all the more notable when we observe that Dr. Chamberlain's name appears on both title pages.

In the 'Morphology of Spermatophytes' we have Part I. of what is evidently to be a work of considerably larger proportions, the present volume being fragmentary, dealing with the Gymnosperms only, and closing somewhat abruptly, even wanting an index. The preface was evidently written for the complete work, and this fact suggests the intention of the authors to bring out Part II. at no distant day. The part before us takes up stem, leaf, root, microsporangium, megasporangium, female gametophyte, male gametophyte, fertilization, and the embryo, for Cycadales, Ginkgoales, Coniferales, and Gnetales, devotes a few pages to fossil Gymnosperms (Cordaitales, Bennettitales, Cycadales, Ginkgoales, and Coniferales), and a few more to the phylogeny, and geographic distribution of the various orders mentioned above. The volume closes with a most useful bibliography of one hundred and ten titles. More than one hundred excellent illustrations (largely original, and often from photographs) add materially to the usefulness of the work.

This book must prove very helpful to the student who is working along morphological lines, and will tend to bring him back to strictly scientific work, in case he has been wandering through the fogs of so-called 'elementary ecology.' A valuable feature of the book is the citation and discussion of the different views held by botanists as to the morphology of particular structures. While the conclusions reached are not always those which we can approve, the treatment is such that the student is led to look on all sides of every problem before a decision is reached. We can not accept the authors' views as to the morphology of the structure supporting the ovules of *Ginkgo* (which we hold to be foliar instead of axial), nor that of the 'ovuliferous scale' of the Abietinæ (which we interpret as an enlargement and extension of ovular tissue; *i. e.*, it is ovular instead of axial or foliar in nature).

Dr. Chamberlain's book must prove useful in histological work in botanical laboratories in high schools and colleges. The plan of the work includes two parts, in the first of which are ten short chapters on apparatus, reagents, the making of mounts, killing and fixing agents, staining and the celloidin and glycerine methods. The author's success as an investigator and teacher is a guarantee of the value of the suggestions made in these chapters. The second part is mainly a series of selected examples of algæ, fungi, bryophytes, pteridophytes, and spermatophytes, in which the preceding suggestions are applied. This portion of the book is an admirable introduction to the vegetable kingdom, and must commend the volume to teachers and students. The book closes with a handy chapter of formulæ of reagents, and a good index.

These works are creditable to the university from which they appear, and deserve to be widely used.

CHARLES E. BESSEY.

SCIENTIFIC JOURNALS AND ARTICLES.

No. LIII. of the *Journal of American Folk-Lore* begins with a paper by Dr. J. W. Fewkes, in which he explains and interprets the Katcina worship of the Hopi or Moki of Arizona. The word is used to denote a masked personage, who, in a ceremonial dance, represents a divine being. Dr. Fewkes shows that these beings are spirits of clan ancestors, who are supposed to return from their dwelling in the underworld. Thus in mortuary prayers, the dying are addressed as about to become Katcinas, and are implored to send rain. Of the Katcinas, some are eponyms of Hopi clans; others are imported from abroad, or are imaginary creations. Chief of these spirits are the Sun Father and Earth Mother, parents of all clans. With sun worship also are connected some of the festivals; in the two great feasts of the Katcina clan are dramatized the arrival and departure of the Katcinas, who are supposed to leave the pueblo in July and return in February. They are said to go to the San Francisco mountains; but the underlying idea is that they enter the underworld through the gate of the Sun-house, the situation of which is indicated by a notch in these mountains, being the place of sunset at the time of the winter solstice. In the dramatic action held in the