are employed, a specialist for each science, who, to guard against error, review each reference before publication.

It is a matter of congratulation that this country leads in the number of subscribers to the catalogue, the number being 96, equivalent to over 70 complete sets. The individual volumes may be subscribed to for a sum *pro rata* to the cost of the full set. As the yearly subscription to the full set of seventeen volumes is $85, this is an encouraging showing. Although this catalogue has not been free from the defects and consequent criticism attending all new enterprises, the work itself is being done in a way to furnish a helping hand to both librarians and students who have long needed a concise subject index to the great and ever-increasing scientific literature of the day. This field the International Catalogue of Scientific Literature aims to cover.

CYRUS ADLER.

SMITHSONIAN INSTITUTION,
June 19, 1903.

---

## *SCIENTIFIC BOOKS.*

### NEW TEXT-BOOKS IN PHYSICS.

*A Laboratory Manual of Physics.* By HENRY C. CHESTON, PHILIP R. DEAN and CHARLES E. TIMMERMAN. New York, American Book Company. 1903. Pp. 128.

*Laboratory Exercises in Physics.* By GEORGE R. TWISS. New York, The Macmillan Company. 1902. Pp. 193.

*A Manual of Elementary Practical Physics.* By JULIUS HORTVET. Minneapolis, H. W. Wilson. 1902. Pp. 276.

*Practical Physics for Students of Science and Engineering.* By ERVIN S. FERRY. LaFayette, Ind., Burt-Terry-Wilson Co. 1903. Part I. Pp. 146.

*Mechanics, Molecular Physics and Heat.* By ROBERT A. MILLIKAN. Chicago, Scott, Foresman & Co. 1902. Pp. 242.

*Elements of Physics.* By FERNANDO SANFORD. New York, Henry Holt & Co. 1902. Pp. 426.

*Elements of Physics.* By ERNEST J. ANDREWS and H. N. HOWLAND. New York, The Macmillan Company. 1903. Pp. 386.

*Introduction to Physical Science.* By ALFRED PAYSON GAGE. Boston, Ginn & Co. 1902. Pp. 359.

*Text-Book of Physics.* By R. A. LEHFELDT. London, Edward Arnold. 1902. Pp. 304.

*Light, for Students.* By EDWIN EDSER. London, Macmillan & Co. 1902. Pp. 571.

*Lehrbuch der Physik;* Erster Band, Mechanik. Von O. D. CHWOLSON, St. Petersburg; übersetzt von H. PFLAUM. Braunschweig, Friedrich Vieweg und Sohn. 1902. Pp. 791.

The annual crop of new text-books of physics is becoming so large that the bewildered reviewer is scarcely able any longer to discuss them distributively; or, if so, it has to be by some system of grouping with comparison of the members of each group. A threefold division may perhaps be made according to the apparent aims of the authors. The first group consists of those which are intended for use chiefly or entirely in the laboratory. The second is made up of those adapted for class-room use in connection with oral exposition. The third includes books intended neither for the laboratory nor for the class-room primarily, but as systematic presentations of principle, to be mastered by private reading in courses of parallel study accompanying the formal lectures or in preparation for formal examinations.

To the first group distinctly belong the first four books of the present list. In the preparation of an elementary laboratory manual there is no longer much range for great originality or for adaptation to a large clientage. The first volume is a little book of 128 pages, prepared by three authors, who frankly begin by saying: "The reason for adding this book to the large number of laboratory manuals is that those now in use either contain too much matter to be successfully covered by a pupil in one year, or elaborate the principles chosen without regard to economy in time." The authors of the other manuals may perhaps differ with these authors as to what constitutes too much matter and in regard

to economy of time. Everything depends upon the special circumstances to which each author has to adapt himself. Any laboratory teacher will probably be able to extract something useful from any laboratory manual if he is alert. Instructions must be well methodized and put into good form, but in no case can they be a complete substitute for the instructions needed in any laboratory other than that in which the given manual was developed. The volumes by Mr. Twiss and Mr. Hortvet are, like the first, good examples of method, all of them being intended for secondary schools, but containing material that can be utilized by beginners in college. Their purpose is, as well expressed by Mr. Hortvet, 'to teach pupils to measure accurately, to manipulate carefully, to work methodically, to see fully, to reason intelligently and to express their observations and results clearly.' It would be an untold blessing to all students of science, irrespective of age or specialty, if such ideals were unceasingly kept in view and even approximately attained.

The small volume by Professor Ferry is the first of a series consisting of four parts, the second of which is now in press. They are intended for students who have a distinct object in view, that of preparation for the profession of engineering. They are, like all such books, the outcome of local needs, where a large number of students require simultaneous attention. The aim is 'to furnish the student with a laboratory manual of physical processes and measurements in which the explanation of the theory and the description of the method of manipulation of each experiment is so complete as to preclude the necessity of consulting either another book or a laboratory instructor.' Doubtless there are many besides the reviewer who have been doing just this task for years past. Hundreds of pages of manuscript have been prepared, some of which are discarded every year, while the need of new instructions adapted to changing conditions is periodically presenting itself. Many of the details of routine may be confided to assistants, but the calls upon the laboratory director will cease only when he gives up his post. Nevertheless the method is on the whole economical. It saves much repetition; it enables the slow student to study out difficulties with a minimum of personal aid; it tends to make him appreciate the advantage of depending on himself to supplement by thought whatever shortcomings may seem to exist on pages prepared for the average student rather than for any single individual. Professor Ferry has done his work with much skill, showing on every page his decided possession of the teacher's instinct. If he should find, by the time the fourth volume is out of press, that the first volume is much in need of revision, because of expansion and other changes in his laboratory, he will at least enjoy the satisfaction of having much good company in patiently performing the labor of Sisyphus and doing it well.

Dr. Millikan's book is a presentation of part of the work in general physics given to first-year students at the University of Chicago. It presupposes the possession of an abundance of apparatus of fine quality, all of which is thoroughly modern, and much of which has been designed and made initially for the Ryerson laboratory. The book is a combination of laboratory manual with class-room text. There are many teachers, therefore, to whom, on this account, the present volume will partially fail to commend itself. On such a subject no procrustean rules can be laid down, but each teacher must work out for himself the system of instruction by which he can attain the best results. Dr. Millikan's method is to divide his time nearly equally between class-room and laboratory work; but the former is wholly occupied with the discussion of the principles presented in the text and their application to practical problems. No demonstration lectures whatever are given until the last third of the year, when there is offered a discussion of those topics that have been omitted from the preceding courses because what is known about them is largely qualitative rather than quantitative. Such subjects as electrostatics, electric radiation, physiological optics and acoustics, the radiation, absorption, polarization and interference of light, are hence deemed suitable for initial

presentation in the lecture room rather than the laboratory. The student is assumed to have already completed a good high-school course, and the aim is not so much to acquaint him with interesting phenomena as to put him in touch with the methods and means of physical investigation. Whether the book can be profitably used by teachers of physics generally, by putting it into the hands of their students, it is not possible to make any positive assertion; but it can not fail to be very suggestive and otherwise useful to all whose range of duty coincides even in part with that of the author.

Professor Sanford's book is like that of Dr. Millikan in one important particular, that it is intended jointly as a presentation of theory and a laboratory guide. He believes the lecture-room method of imparting knowledge to be the poorest of all methods with elementary students, and his book has been written with the idea that it will not need supplementing by a lecture course. "It has been prepared especially for the teacher who has had an adequate training in the physical laboratory, and it is not likely to succeed with any other teacher." It is issued more especially for California students of high-school grade who compose a majority of the applicants for admission to the Stanford University; but it is evidently best suited for that increasing proportion of high schools in which the work encroaches largely on that of the college, and which seem destined within the next generation to supplant the small college in all except the thinly populated parts of our country. The author lays much stress on the importance of following in the laboratory the general method of scientific discovery, in which the acquisition of individual facts must precede generalization, while this in turn is followed by deduction and such special experimentation as is necessary to test its validity. Among the salient features of the book are the attempt to base the initial development of mechanics consistently upon the concept of energy, the discussion of the gaseous state of matter as a preliminary to that of the liquid and solid states, and in optics the complete elimination of 'the fiction of rectilinear propagation.' This last is a self-imposed and quite unnecessary limitation. If we admit the wave theory and the existence of wave fronts in a medium with known properties, the direction of propagation becomes as recognizable as the wave front, and it can scarcely be called a fiction unless the medium is also fictitious. The luminiferous ether may perhaps be still called a fiction, though one of great convenience and an intellectual necessity at present. Whether the wave front method or the ray method of explaining optical phenomena be preferred is a matter of convenience or of fashion. There can be no inconsistency in using both or either at will, and certainly each has its own advantages.

The volume by Messrs. Andrews and Howland presents no such departures from prevailing usage as the two just noticed. It is well balanced, well arranged and clear in style, but it contains no features that have not been exemplified in some of the better elementary class text-books in common use. The general plan of the authors has been to eliminate subjects that are of mere theoretic interest and to emphasize those that are practical; to use the simplest language possible and to avoid mathematical formulas in all cases where these are not absolutely necessary; to show as much as possible, for every subject selected, its relation to fundamental principles or their obvious corollaries.

Gage's 'Introduction to Physical Science' is a revised edition of a book that has been on the market since 1887. The author was at that time the well-known champion of the idea, at present advocated anew by Professor Sanford, that the student must be an inductive investigator. Mr. Gage now fully recognizes 'the consensus of opinion among teachers of physics that the method of instruction which includes a due proportion of text-book study, lecture-room demonstration and individual work in the laboratory is the method conducive to the highest order of results from an educational point of view.' The present volume is essentially a class text-book, and not a laboratory manual or a reading book for parallel private study. It is

scarcely necessary for the present writer to repeat what he has said in commendation of Mr. Gage's skill as a text-book writer, manifested in other books reviewed in the columns of SCIENCE. He is fully up to the standard set in those volumes.

The third group of text-books, intended for parallel reading or private study, is exemplified by the last three books on our list. This, perhaps, might be expected from the fact that the authors are writing for readers on the other side of the Atlantic, two of them being English and the third a Russian. There has been a distinctly American evolution of educational methods; and this fact, quite independently of any author's individual merit, causes few foreign text-books to be now available for text-book purposes in American schools, except for advanced students.

Lehfeldt's 'Text-Book of Physics' is written for students of medicine, and the author has endeavored, therefore, to exclude mathematical formulas as much as possible. The mode of arrangement is not to be commended, there being many long paragraphs and but little to aid the reader in singling out salient points. It is impossible to avoid formulas entirely, and these are incorporated quite frequently in the midst of the paragraphs, instead of being put separately and equationally so that mutual relations may be readily perceived. The book contains no problems. Chapter VI., entitled 'Chemistry,' is made up wholly of paragraphs in fine print on such subjects as the law of mass action, the phase rule, thermo-chemistry, and the relation of heat to chemical equilibrium. A single paragraph of this fine print, considerably more than a page in length, consists of seventeen sentences. The book was written with a view to attracting attention to the intimate dependence of physiology on physical principles, and is made up of the author's lectures to students preparing for the intermediate examination at London University.

Edser's 'Light for Students' is written by one who is far better versed in the art of book-making. The paragraphing is good. The illustrations, chiefly diagrams with white lines on a black ground, are clear and well selected. Mathematical formulas are used wherever necessary, and the deduction of them is usually in good shape, no knowledge of calculus being assumed. In discussing the wave theory the author recognizes the rectilinear propagation of light, not as a 'fiction' but as a resultant of wave motion, and light rays are assumed equally with wave fronts whenever suggested by convenience. Among the illustrations are several selections from Professor Wood's excellent photographs of air waves taken by the 'Schlieren-Methode.' Modern advances are noticed, including the production of stationary light waves by Wiener and Lippmann, the interferometer work of Michelson, and his echelon grating. The light phenomena accompanying electric discharges in high vacua come in for attention, X-rays being regarded as probably those of ultra-violet light of extremely short wavelength. The radiation from salts of uranium, polonium, actinium and radium is mentioned, but as the date of the preface is September, 1902, this subject is noticed more briefly than it would be to-day. The book is, on the whole, much to be commended.

The first volume of Chwolson's 'Physics' was published in 1897, at St. Petersburg, in the Russian language. A second edition appeared in 1900 and was brought to the attention of Professor Wiedemann at Erlangen. Appreciating its excellence, he took steps to secure its translation into German. This task was undertaken by Dr. Pflaum in Riga and the risk of publication assumed by Vieweg in Braunschweig.

Of late years two notable books on chemistry have come from Russians, the one by Mendelejeff, the other by Menschutkin; but neither could exert any important influence on the scientific world until freed from the shackles of an unspeakably difficult language. Chwolson's book is now in process of similar deliverance, and it has already received marked attention in Germany. The first volume, of nearly 800 pages in German, relates to the mechanics of gases, liquids and solids. The second, on acoustics and radiant energy, was to appear in Russian in 1898. The third relates to heat, and the fourth to

magnetism and electricity. The book has been written to meet the needs of university students, and in the first part it is assumed that the student has not yet had an opportunity to become acquainted with the methods of calculus; but this assumption is soon discarded.

The range of the first volume may be briefly indicated by an enumeration of subdivisions. After an introduction of fifty pages come the subjects of motion, force, work and energy, harmonic motion, radiant propagation of vibratory motion, universal gravitation, the potential theory, gravity. Then follows a section on instruments and methods of measurement, and separate sections on the theory of gases, theory of liquids and theory of solid bodies, the last including a discussion of elasticity and of friction. The style of presentation is clear and direct, and frequent brief summaries help the reader to seize upon fundamental principles. Each section closes with an index of literature relating to its subject matter.

Quite possibly the state of the American market may not warrant the translation of this excellent treatise into our language, but it is well worth the attention of those who are sufficiently interested to examine the German edition. W. LECONTE STEVENS.

## SOCIETIES AND ACADEMIES.

### BIBLIOGRAPHICAL SOCIETY OF CHICAGO.

A REGULAR meeting of the Bibliographical Society of Chicago was held in connection with the annual meeting of the American Library Association on the afternoon of Wednesday, June 22, at Niagara Falls. After the president's address by Mr. A. G. S. Josephson, a paper on the 'International Catalogue of Scientific Literature,' by Dr. Adler was read. This paper is published above.

Dr. Herbert Haviland Field, of Zürich, was introduced and gave an account of the Concilium Bibliographicum founded in Zürich by the third International Congress of Zoology, in 1895. This institution collects and records all publications in biology, giving to each article separate cards of Library Bureau size. These cards aggregate at present twelve million for 150,000 titles, and thus constitute one of the largest, if not, indeed, the largest, collection of printed bibliographical cards. The Concilium Bibliographicum regards it as a technical triumph to have produced these cards for sale at the low price of one fifth cent per card. The cards are classified according to a methodical classification which is a development of the Dewey decimal system. For each topic found in the various publications there is a separate card published. In determining the various entries the text and not the title of the publication is considered, the number of entries for a single work often attaining ten or twelve. Besides supplying libraries and other institutions with complete sets of cards, the Concilium permits individual investigators to order cards for their own specialties. Thus the traveler going to Borneo could apply for the cards dealing with the fauna of Borneo. He would receive these at a nominal charge. In like manner any topic of investigation whatsoever can be asked for. The Institute is to-day nearly self-supporting, though it receives an annual subsidy of $1,500 from the Swiss Federal Government. It confidently hopes that bibliographers in America will lend it their support in obtaining similar financial aid in the United States.

Mr. Wilberforce Eames, of the Lenox Library, New York, presented a report in favor of the formation of an American Bibliographical Society and recommended that the Bibliographical Society of Chicago be authorized to take the initiative in the formation of the society. The report was adopted and active steps toward organization will be taken in the fall. CHARLES H. BROWN,

*Secretary.*

## DISCUSSION AND CORRESPONDENCE.

### THE ST. LOUIS CONGRESS OF THE ARTS AND SCIENCES.

TO THE EDITOR OF SCIENCE: In the May number of the *Atlantic Monthly* there appeared an article by Dr. Hugo Münsterberg, giving, in a quasi-official manner, a statement of the plans for the St. Louis Congress of