Book Reviews

Die Mathematischen Hilfsmittel des Physikers. 4th ed. Vol. IV of *Die Grundlehren der Mathematischen Wissenschaften in Einzeldarstellungen.* Erwin Madelung. W. Berlin: Springer-Verlag, 1950. 531 pp. Illus. $11.88.

Madelung's book has been considerably enlarged and in many parts completely rewritten in its fourth edition.

This work is not a textbook, neither is it a collection of formulas. Originating from the author's collection of mathematical notes to his lectures in theoretical physics, it was intended to be for the theoretical physicist what Kohlrausch's *Practical Physics* is for the experimentalist. This goal has not been attained. Kohlrausch's book is a text of experimental physics in terms of definite problems and their solution, whereas Madelung's is a compendium of mathematics (350 pp.), followed by a brief summary of theoretical physics (143 pp.) arranged in the conventional sequence of textbooks. Thus, the mathematical tools are developed and discussed in some detail without reference to the physical applications (see, for example, the introduction to spin matrices, p. 25, and Clifford's numbers, pp. 12 and 25). Special developments are included in an appendix of about 30 pages.

The sequence follows the outline of the third edition, which was reprinted by Dover during the war. A first chapter on numbers, functions, and operators is entirely new and has been added in view of the widespread use of operators by physicists in recent years. In this chapter some of the tools of quantum mechanical calculations are formally introduced.

A brief chapter on differential and integral calculus is followed by series and series developments, a chapter on functions (including some 50 pages on special functions), and a chapter on algebraic transformation. The detailed and well-developed chapter on vector analysis will be welcome to students and teachers. This is followed by discussions of special coordinate systems, group theory, differential equations, integral equations, calculus of variations, and statistics. Under group theory, a discussion of the crystallographic symmetry groups as used in structure analysis has been added. The chapter on theory of differential equations is written from the point of view of wave mechanics and modern physics.

The discussion of general relativity theory has been cut considerably—the Einstein effects formerly discussed in an appendix are now mentioned in three lines. This was inevitable, however, if the new mathematical techniques, modern developments in quantum mechanics, and the approach to problems of field theory were to be discussed.

Physics is discussed in separate chapters on mechanics, electrodynamics, relativity, quantum theory, thermodynamics, and statistical methods. Crystal optics, as part of electrodynamics, is particularly well summarized, and the same thing is true of the discussion of thermodynamics. However, some of the more modern applications would be welcome, particularly statistical applications to the theory of the solid state.

The literature contains only a few new references, published since the third edition came out. The index, quite important in a book of this type, has been cut to five and one-half pages for the 500 pages of text—whereas the index in the third edition was more than ten pages, covering a text of some 350 pages. The index is now so brief that it is not quite clear what will be found under a particular heading. For example, "Approximation methods" are quite important for the use of such a book; in the former edition there were five entries describing in detail the approximation referred to. At the present time there is just one entry.

This reviewer hopes that, if another edition comes out, particular care will be taken to make the index so complete that it will be simple for a physicist to find the material he needs for the understanding of theoretical developments in his own field.

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Survey of Biological Progress, Vol. II. George S. Avery, Jr., Ed. New York: Academic Press, 1952. 333 pp. Illus. $7.00.

This thin volume is the latest of a series begun in 1949. It covers a broad field of biology—ranging from genetics to physical chemistry and from anatomy to plant pharmacology. By and large it is a moderately interesting volume and one in which most biologists will find at least one article they can read with profit.

The first paper, "The Effects of Radiation on Biological Systems," by A. H. Sparrow and B. A. Rubin, is a most useful, concise presentation of modern thoughts on the inorganic and physical chemistry, physics, and biology of radiobiology. It includes a detailed discussion of the target theory and its interpretation in modern chemical terms. Here also is a precise summary of our knowledge of the ions and radicals formed by the varied kinds of high-energy radiations. Finally, the varied biological effects of radiation are treated with respect to mutation and cytology and physiology. Similarities and differences of the effects of high-energy radiations are outlined in an admirable way. This is an outstanding article—one that might well be read by all biologists not themselves specialists in the field.

"Progress in Human Genetics," by H. Kalmus summarizes the little we know about human genetics. Kalmus brings together, in rather general terms, much about the inheritance of human traits as well as modern information on mutation rates, and interesting calculations about the size of mating groups in the human community.

Gordon Riley's "Biological Oceanography" flows along in an admirable way and is a pleasure to read. Dr. Riley's emphasis is on ecological matters, and some might wish that he could bring a little more specific information to bear on the intricate problems of life in the ocean.

Erwin Bünning, who has written extensively in German on morphogenesis and related matters in higher plants, has prepared an English summary of his views for this volume. Bünning is a hard master, and the reader must follow his involved arguments with care if he is to follow them at all. This author does, however, present extraordinarily lucid and specific chemical interpretations of the forces that control and guide the course of morphogenesis. To Bünning, we have in higher plants clear evidence of induction of differentiation by specific substances. An important part of his discussion is that concerned with his principle of mutual incompatibility of regions of vigorous protoplasmic growth—a principle which again finds its basis in Bünning's mind in competition for specific chemical substances. He also takes care to differentiate between regulators, which bring about cellular activity in general, and determiners, which channel differentiation along particular pathways. It is high time that a clear distinction of this kind be made in the discussion of plant morphogenesis.

The review by L. G. Nickell concerns the rapidly developing field of the chemical regulators of plant growth. He considers the auxins and related compounds in weed control and in other agricultural problems and deals briefly with certain auxiliary matters such as the toxicity of these compounds to animals. The whole discussion is on a descriptive basis, however, and does not attempt to synthesize the thoughts of various workers concerning why these compounds act the way they do; nor does he consider the systematization of our knowledge of chemical structure and biological activity in these compounds.

Histochemistry is now undergoing rapid development along two rather distinct lines. Florence Moog adheres to the school of thought which proposes to study the cellular localization of enzymatic reactions in tissue slices as followed under the microscope. Her paper stresses this approach rather than the approach of physical separation of cellular constituents, which has proved so fruitful. To the reviewer it would seem that Moog's discussion merely establishes again that the classical methods of histochemistry are less sure in application to the living cell than are those of differential centrifugation.

Cell structure also plays an important role in L. H. Bretschneider's review, "The Fine Structure of Protoplasm." Bretschneider presents a cogent and closely reasoned argument for the supposition that protoplasm does indeed possess a structure of submicroscopic strands, each with a diameter of roughly 50–200 A. These fibrillar structures can be seen in electron micrographs of many types of dehydrated cytoplasm. To the reviewer it is still open to question whether these same units, designated by Bretschneider as "leptons," are in fact to be found in the native hydrated cytoplasm.

The final contribution, by Aubrey W. Naylor, "Physiology of Reproduction in Plants," includes not only a summary of past work in the reproduction of fungi and algae, but also a considerable discussion of reproduction of higher plants.

If one general criticism might be leveled at the present volume, it would be that several of the papers are diffuse, general, and overly talkative. They lack the initial clear delineation of the problem and the concise treatment that have become characteristic of reviews in chemistry and biochemistry. The subjects presented here are important and interesting ones. They deserve treatment in a precise, brief manner, and with clear terminology.

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Scientific Book Register

Elsevier's Encyclopaedia of Organic Chemistry. Series III: ***Carboisocyclic Condensed Compounds,*** Vol. 14, Suppl. 2: ***Triterpenes.*** F. Radt, Ed.; Dora Stern, Coeditor. Amsterdam-Houston: Elsevier, 1952. 407 pp. + 50 pp. index. $40.00; set subscription price, $30.00.

The Trichoptera (Caddis-Flies) of Australia and New Zealand. Described and figured by Martin E. Mosely and D. E. Kimmins. London: British Museum (Natural History), 1953. 550 pp. Illus. £4 10s.

Ciba Foundation Colloquia on Endocrinology. Vol. I, ***Steroid Hormones and Tumour Growth and Steroid Hormones and Enzymes;*** Vol. II, ***Steroid Metabolism and Estimation.*** G. E. W. Wolstenholme, Gen. Ed.; Margaret P. Cameron, Asst. New York: Blakiston; London: J. &. A. Churchill, 1952. Vol. I: 315 pp. + plates; Vol. II: 429 pp. Illus.

The Principles of Line Illustration. With emphasis on the requirements of biological and other scientific workers. L. N. Staniland. Cambridge, Mass.: Harvard Univ. Press, 1953. 212 pp. Illus. $5.00.

Organic Chemistry. Melvin J. Astle and J. Reid Shelton. New York: Harper, 1953. 771 pp. Illus. $7.50.

What Is Science? Repr. Norman Campbell. New York: Dover, 1952. 186 pp. $2.50; paperbound, $1.25.

The New Force: The Story of Atoms and People. Ralph E. Lapp. New York: Harper, 1953. 238 pp. $3.00.

Statistical Theory in Research, Part I: ***Basic Statistical Theory;*** Part II: ***Analysis of Experimental Models by Least Squares.*** R. L. Anderson and T. A. Bancroft. New York–London: McGraw-Hill, 1952. 399 pp. $7.00.

Dating the Past: An Introduction to Geochronology. 3rd ed. Frederick E. Zeuner. London: Methuen; New York: Longmans, Green, 1952. 495 pp., illus., and 24 plates. $8.00.

Lectures on Cauchy's Problem in Linear Partial Differential Equations. Repr. Jacques Hadamard. New York: Dover, 1952. 316 pp. Illus. $3.50; paperbound $1.70.

Advanced Statistical Methods in Biometric Research. C. Radhakrishna Rao. New York: Wiley; London: Chapman & Hall, 1952. 390 pp. $7.50.