Book Reviews

Advances in biological and medical physics. (Vol. I.) John H. Lawrence and J. G. Hamilton. (Eds.) New York: Academic Press, 1948. Pp. xi + 484. $8.60.

In a rapidly widening biological field the use of physics either directly or by implication is essential. Effective entry into this field can be made only by surmounting several difficulties, one of the worst being the scattered nature of the literature needed for study before work is begun. The advent of a series comparable to *Advances in enzymology* is therefore of great importance and undoubtedly will greatly further the development of the new field of biophysics.

The present volume contains a series of authoritative articles centered around radioactivity and isotopic tracers, both radioactive and stable. For the first time a collection of reviews of work on nitrogen, carbon, iron, phosphorus, and iodine metabolism, written by such authorities as Vennesland, Hahn, Chaikoff, Zilversmit, and Leblond, is available. In addition, a highly significant discussion of nucleic acid metabolism by Hevesy is included. These articles form the unique and essential part of the volume. Very valuable reviews on the general use of isotopes in medicine, the nature of artificial radioactivity, radioactive instrumentation, and health physics by Dougherty and Lawrence, Cohn, Evans, and Parker supplement the accounts of actual research advances. In addition, an interesting article by Howland and Stafford Warren on the effects of atom-bomb irradiation is included. There is no doubt at all of the great importance and value of the volume.

There arises the question as to the future of the series. Apparently it is to be primarily concerned with the application of nuclear physics to biology. While this is undoubtedly of high importance, it is to be hoped that other significant developments such as the use of X-rays in elucidating biomolecular structure, action potential measurement in nerve fibers, or ultraviolet and electron microscopy will be included. Finally, a word in favor of interpretative biophysics such as has been attempted by Lea should be added.

The editors and publishers are to be congratulated on initiating a series in a new field of such high interest.

ERNEST C. POLLARD

Yale University

Limnological methods. Paul S. Welch. Philadelphia-Toronto: Blakiston, 1948. Pp. xviii + 381. (Illustrated.) $7.00.

The past 35 years have seen the rapid expansion of limnology, and although many field and laboratory procedures are peculiar to this science, some have been modified or borrowed from geographers, chemists, physicists, and oceanographers. It is a pleasure to see that these procedures, heretofore widely scattered throughout the literature, are now available in one volume. *Limnological methods* is not encyclopedic; it includes only those selected and standard methods considered necessary for (1) an introduction to the subject matter of limnology, (2) lake and stream surveys, and (3) the furtherance of more specialized research.

A large portion of the book deals with mapping procedures. Physical methods include turbidity and color measurements, various types of thermometers, determination of water movements and light penetration, and descriptions of bottom samplers. Selected chemical methods include dissolved oxygen, alkalinity, hydrogen-ion concentration, and specific conductance. A variety of plankton nets, traps, centrifuges, and filters are discussed and their comparative usefulness for quantitative work evaluated. Plankton counting methods are compared. Qualitative and quantitative apparatus for bottom fauna and rooted aquatic plants are also considered.

Each technique and piece of apparatus and its uses are described in logical order, so that even an inexperienced worker can, by following the itemized directions, do an effective piece of field or laboratory work. It is gratifying to note that both the advantages and disadvantages of the different procedures are stressed.

An Appendix contains useful tables, hints on the proper care of ropes, and short descriptions of accessory equipment. It is regrettable that the book does not contain a list of firms and supply houses from which specialized limnological equipment may be purchased.

Although its price is unusually high for a volume of this size, *Limnological methods* is an essential reference for limnology courses and all lake and stream biologists, both theoretical and applied.

ROBERT W. PENNAK

University of Colorado

Modern operational calculus with applications in technical mathematics. N. W. McLachlan. Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1948. Pp. xiv + 218. (Illustrated.) $5.00.

Here is an advanced textbook on operational methods written primarily for postgraduate engineers and technologists. The author has a London doctorate in engineering and has written well-liked engineering textbooks on Bessel functions, Mathieu functions, complex variable, etc.

Like most writers on advanced operational methods, the author bases his methods solely on the Laplace transform. The transform is defined and operational rules are carefully derived, including four results announced as new. The methods are then applied to linear ordinary and partial differential equations with constant coefficients. The next portion of the book is devoted to the evaluation of integrals and the derivation of particular Laplace trans-

forms. There is a mathematical appendix followed by exercises for the reader, with answers where required. The book is completed with a table of 81 Laplace transforms, a few references, and a list of symbols; there is an adequate index.

The mathematical reader will be pleasantly surprised at the standards of mathematical understanding and rigor which the author intends the engineering reader to meet. In the Preface rigorous mathematics is likened to a precision limit-gauge which will eliminate trial-and-error fitting of machined components. This is usable propaganda for any who teach mathematics to engineers.

In addition to the attitude toward mathematical rigor, the book has numerous other good points. There are, for example, common-sense explanations of many matters of real-function theory not usually explained to engineers, such as the various types of discontinuities of a function. The p-multiplied form of the Laplace transform is used and should prove popular with engineers because of its dimensions and analogy to Heaviside's notation. The many mathematical examples, technical applications, and excellent graphs will be appreciated.

There are drawbacks, however. Appendices II and III show the author's knowledge of limit, uniform convergence, and improper integrals to be loose at best. Whether he is actually wrong in certain statements or whether they are merely ambiguous does not matter; in either case he is not teaching the reader the precision of thought which was set forth earlier as necessary in this field. One wonders whether the lack of precision may affect the accuracy of the principal part of the text; the reviewer found no error, however, in the proofs that were checked. Because the mathematical material is condensed and is presented unsystematically, it would seem best for the reader to learn the necessary real-function theory elsewhere. As with some similar books, the reader is unfortunately not told how far the operational calculus can be rigorously founded without use of the Laplace transform.

The book is recommended for collateral reading to those engineers with some knowledge of the field who want to go deeply into the engineering uses of the Laplace transform. Other textbooks, however, offer much better expositions of the subject to the uninitiated.

GEORGE E. FORSYTHE

National Bureau of Standards,
Los Angeles

An introduction to color. Ralph M. Evans. New York: John Wiley; London: Chapman & Hall, 1948. Pp. x + 339. (Illustrated.) $6.00.

Since Newton's experiment on the production of colors by refraction in 1704, there have been perhaps 35 comprehensive treatments of the psychophysics of color. Since Evans' volume is the first important general book since the *Handbuch der normalen und pathologischen Physiologie* in 1929 (excluding the *Report of the Committee on Colorimetry*), it thus has the benefit of the standards adopted by the International Commission on Illumination in 1931, as well as the enormous amount of theoretical and experimental literature which has since appeared.

Ralph M. Evans, head of the Color Control Department of Eastman Kodak, is a physicist by training but has a deeper interest in the psychological effects of color than most psychologists. He is known in the field chiefly for contributions concerning visual processes and color photography and for work on brightness constancy in photographic reproductions. Mr. Evans has obtained a great deal of fame because of the remarkable slide lectures which he has been delivering to the technical societies during the last few years. These lectures are incomparable, being illustrated by a series of slides which could only be the result of his keen organization and the tremendous resources of the Eastman Kodak Company. This volume is a direct outgrowth of these lectures.

Unfortunately, the cost of color reproduction is so high that only 15 full-color, full-page plates could be included in this work. The color reproduction is every bit as good as the other two major attempts to reproduce psychological color phenomena: the *Three monographs on color* published by the International Printing Ink Corporation in 1935, and the article on color which appeared in the July 3, 1944, issue of *Life*. Since the number of illustrations in the book is very small compared to the number included in the lectures, the latter have a comprehensiveness that the book does not.

It is Mr. Evans' intent to use, for the purposes of exposition, no mathematics higher than those taught in high school. Since modern color theory has its setting deep in the principles of projective geometry, this is a serious restriction to have imposed upon himself. To develop his theory with minor mathematics, Evans relies extensively on spectrophotometric curves, and the book abounds with examples. Since psychophysical color must always begin with the spectrophotometric curve, however, the completeness of treatment is most commendable. Evans, too, successfully develops the I. C. I. chromaticity plane under his imposed restriction, and his explanation of the projective relationships between colors on the plane is exceedingly well done. This is probably the only well-rounded discussion at this level of difficulty in the literature.

Evans is at his best, however, when he discusses psychological phenomena. Included in the text are depth perception and illusion which do not really belong to the psychophysics of color, but after the splendid illustrations which are the specialty of Mr. Evans, one can only be glad that they are here made available. The illustrations throughout have a touch of glamour. Other texts have used square blocks to illustrate simultaneous color contrast, but Evans graphically and dramatically illustrates his point by using a blue Aladdin's lamp on different-colored backgrounds.

Even in an introductory book there should perhaps be some discussion of color theory. The concept of a "fundamental sensation curve" relative to some of the better-known theories would probably be of help to a beginning student.

Then, too, there are discussions of matters which need not have been included in an elementary text. For ex-