note, "In recent years a large number of books have been published on the diffraction of x-rays by matter but, to our knowledge, none of them approaches the problem from the standpoint of the theory of Fourier transformation and convolution integral methods in an adequate way. Moreover, problems of diffraction by matter of all kinds have not yet been discussed from a single unified theory. We feel that a book is needed to fill this gap. This book is an attempt towards this aim."

The authors have written a book that more than fulfills their aim, a book whose rigor and thoroughness will make it an important source work for those with interests in x-ray diffraction extending beyond the standard methods of crystal structure analysis. All workers in the field of diffraction microscopy can profit from its presentation of the elegant Fourier transform formulation of diffraction theory.

Since a majority of the readers will not be sufficiently acquainted with the required mathematical methods, the authors have taken special pains to develop in detail the mathematical formalism, ". . . with the earnest desire that it will create the necessary confidence [in the reader]. . . ." The introductory chapter, "Fundamental equations of diffraction of wave fields" is followed by chapters on convolution operations, Fourier transformation, and convolution polynomials, which carefully define these operations and abundantly illustrate their application to pertinent diffraction problems. In order to provide a rigorous mathematical base for the Fourier transformations that have to be carried out, the concept of a function complex is introduced, and a chapter is devoted to the fundamentals of function algebra.

The main substance of the book occupies 13 additional chapters. These chapters are devoted to characterizing diffraction from a general structure and to specialization of the general equations to cases of single crystals, paracrystalline materials, polydispersed globular aggregates, micellar and fibrillar systems, and fluids. The analyses are based in part on the concept of a generalized Patterson function, the so-called Q-function introduced by the authors, and it is shown that, under certain conditions, structures can, in principle, be determined uniquely from this experimentally obtainable function. Unfortunately, this method has little practical application to actual crystal structure analysis. The large number of optical diffraction patterns that are analyzed to illustrate the implications of the theory are very useful. The authors, however, are occasionally carried away with the value of these models, as illustrated by the naive ideas presented on some biological structures. A detailed analysis is given of diffraction by paracrystalline substances, which will be of particular interest to workers concerned with the poorly-ordered colloidal and fibrous macromolecular systems.

This book is oriented primarily toward the theoretical analysis of diffraction, and will be most useful to those wishing to delve into this aspect from the point of view of Fourier transformation.

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Astrophysics

Astrophysical Quantities. C. W. Allen. Oxford University Press, New York, ed. 2, 1963. xii + 291 pp. Illus. $10.10.

One has only to glance at the list of references given in the current astrophysical literature to appreciate how widely the first edition of Allen's *Astrophysical Quantities* has been used. Allen has now prepared a second edition of this most useful compilation of tables, numerical constants, and formulae. The material is carefully arranged in such a way that needed information can be found quickly, the relevant units are clearly given, and each section lists the references from which the tabulated numbers have been extracted. In some instances—for example, infrared absorption of the earth's atmosphere—the complete data are so extensive that tabulation is not feasible and information must be presented graphically.

The practicing astronomical spectroscopist will find the tabulation of stellar continuum absorption coefficients very useful, although more accurate calculations could now be made and for different stellar compositions. The section on empirical transition probabilities has been greatly extended in this edition; published tabulations of theoretical line and multiplet strengths have not shown as marked an improvement. Some workers (for example, Garstang) have published useful results on line strengths for individual ions. Others preferred to publish erudite ideographs rather than urgently needed tables and data.

In some tabulations, it might have been preferable to select data from just one of the authorities quoted rather than to take averages. For example, the compilation of data for the solar interior given on page 163 represents means from the work of several theoreticians who attacked the problem with different assumptions and at different levels of sophistication. Hence the results are not truly comparable; they refer to different things.

Every reader will find places where he would have handled the data in a different way. In particular, one may be less enthusiastic about sections in which he considers himself to be an authority than about other parts. But this book was not written as a substitute for the astrophysical literature. Rather, it is a concise, handy, reliable compilation of the data needed by the practising astronomer, astrophysicist, and physicist or geophysicist working on astronomical problems. In this task Allen has succeeded admirably, and the scientific world owes him a great debt of gratitude for the patience, care, and good judgment he has exercised.

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Secondary School Biology

Research Problems in Biology. Investigations for students. Series 1 and 2. Prepared under the direction of the Curriculum Study, American Institute of Biological Sciences. Doubleday, Garden City, N.Y., 1963. Series 1, xxxvi + 242 pp.; series 2, xxx + 244 pp. Paper, 95¢ each.

The energy and imagination that those who work with the Biological Sciences Curriculum Study have put into developing new approaches to the teaching of secondary school biology is clearly illustrated in these two small volumes. Each consists of 40 research projects, contributed by research biologists, which cover a wide range of areas in animal behavior, animal physiology, ecology, genetics, growth and development, microbiology, and plant physiology. Each project is introduced by a skillful résumé of the pertinent literature so that the significance of

the project and its relation to the field of investigation is carefully pointed out. This is followed by a discussion of suggested problems that emphasize the nature of the questions which the scientist poses. This is the very heart of the project, and it is here that these volumes demonstrate their excellence and provide a sharp contrast with the typical Science Fair project, which will, I hope, profit by the example. Procedures for carrying out the investigation are suggested and possible pitfalls discussed. Each project is concluded with a list of references, both general and specific.

The projects are not too difficult technically for gifted high school students, nor do they require expensive and complicated apparatus. Commendably, a challenging feature of many of the projects is the emphasis placed on the student's ingenuity in constructing equipment for use in the investigation. But perhaps the most stimulating feature of all is that the great majority of the projects are concerned with questions still largely unanswered. Indeed, "all the projects are in fact invitations to discovery. They emphasize inquiry and encourage independent work; they are presented as a means of developing the artistry of investigation." I know of no more effective way to acquire understanding of science.

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Career Guidance

Careers in the Biological Sciences. William W. Fox, Walck, New York, 1963. 114 pp. Illus. $3.50.

To one who must answer inquiries from secondary school students about careers in the biological sciences, the appearance of a new book on the subject is welcome, because no book written by a single individual is sufficient. The present little book may be recommended to those who are attracted by out-of-doors biology, for the author himself is experienced in and understands the characteristics of applied nonmedical biology, or agricultural science.

Seven of the nine chapters are intended to excite interest in different biological occupations through specific examples of accomplishments toward human welfare in each. The weakest of those chapters is the one entitled "Thoughtful sciences." It fails to illuminate the attraction that fundamental biological research has for many young people. To be sure, the author realizes that "most people who work and study in these sciences do so because they want to know . . .," but he does not depict the broad scope of fundamental biology, its connections with and dependence upon chemistry, physics, and mathematics, the intellectual challenge and excitement of its pursuit, and its contributions to human welfare in the hands of its scholars and others.

Of the next six chapters, only one deals with biology underlying medicine; the other five give some interesting examples of practical agricultural and wildlife biology, quite worthwhile for a young person who wants to know what goes on in certain scientific services of the departments of Agriculture and Interior.

The first chapter of this book, "The science of life," is pathetically inadequate and might be misleading; it should be skipped. However, the last chapter, "About the job," has some sound information. The 29 photographs in the book give the reader impressions of laboratory and field environments in which biologists work.

Summing up, I find that this book is a light-weight production; it will have little influence on the advance of the biological sciences.

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Notes

Paleoecology

Principles of Paleoecology (McGraw-Hill, New York, 1963. 383 pp. Illus. $10.75), by Derek V. Ager, meets the long-felt need for an English language textbook in this field, probably as well as possible in a reasonable amount of space and considering the present state of knowledge with respect to the subject. Although the concepts and practices set forth here are documented in a scholarly manner, the author wisely and explicitly does not attempt to be exhaustive but stays close to the baseline of his own experience and interest. He manages, nevertheless, to cover much of the important ground, the material is well illustrated, and his bibliography of more than 500 references provides an ample list for supplementary reading. Like any first textbook in a rapidly developing field, this one will probably be improved upon. But it moves a long way in the right direction, and it attains, with clarity and directness, its modest stated aim "to introduce . . . a field of study."

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Crystallography

Crystal Orientation Manual (Columbia University Press, New York, 1963. 85 pp. Illus. $4), by Elizabeth A. Wood, is a collection of basic information needed for orientation of crystals for physical measurement or experimentation. By *orient* is meant the process of adjusting a crystal until its orientation relative to a fixed holder is that required for some particular operation or measurement. The determination of the orientation of crystalline grains in a specimen, as in petrofabric study, is not included. The text is divided into 25 short sections and 3 appendixes. The first section (1 page) outlines the procedure for orienting a crystal with references to other sections. The next 12 sections, which deal with basic crystallographic concepts, are followed by two sections on the mechanics of handling a crystal. The remaining sections are devoted to x-ray diffraction methods of determining orientation and include several useful tables and collections of formulae. The appendixes are concerned with the use of polarized light in orienting transparent crystals, examples of Laue photographs, and a brief summary of hexagonal-rhombohedral relationships. The many figures are very well drawn and reproduced.

This manual should be of great value to the numerous chemists, physicists, engineers, and technicians who are faced with the problem of obtaining a suitably oriented rod or section of crystal for their experiments but who lack training in crystallography.

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