on the fact that each of the contributors is an active worker in the field and presents his data.

There are few papers in this volume which show the primate used instead of another animal that would have given equally valid and predictable results; in the majority of papers, the comparative aspects are emphasized, whether the comparison is of one primate with another or of a primate with a nonprimate and whether drug metabolism or psychopharmacology is being discussed. This is a recurrent theme in the otherwise diverse papers.

Probably the characteristic of primates that is most attractive to those of us whose ultimate aim is the extrapolation of findings to our own species is their varied and extensive behavioral repertoire. For this reason the largest section of the book (184 pp.) is concerned with neurophysiological and behavioral studies. The behavioral aspect has not been neglected in other sections, however, for biochemical derangements can be correlated with behavior as they are manifested in human disease conditions. Similarly, where behavior is the disturbance of primary interest, as in drug abuse, biochemical events are sought to mirror these changes. The animal-drug interaction occurs at many levels, and it is nice to see that most of these contributors recognize the integration of one physiological system with another.

As is common with books of this sort, each presenter provides his tables and graphs in his own form, and as usual some are less well constructed than others. The only other comment to be made is that some of the questions asked from the audience could have been edited out as superficial and noncontributory. By the same token, however, the record is certainly complete.

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Molecular Data on Enzymes

Enzyme Handbook. THOMAS E. BARMAN. Springer-Verlag, New York, 1969. 2 vols. xvi + 928 pp. $19.50.

The *Enzyme Handbook* is a two-volume collection of data on 1300 enzymes organized in numerical sequence according to the classification of the International Commission on Enzymes. With varying degrees of completeness it provides information on the equilibrium constant, molecular weight, specific activity, specificity, Michaelis constants, inhibitors, and light absorption and references for enzymes cited in the literature up to early 1968. It probably is the most exhaustive listing of known enzymes. As is pointed out in the foreword, "It would be foolish to hope that a handbook of this kind will provide all the information about enzymes which different specialists would wish to find." The futility of this hope is proven adequately. At best the handbook is a good though somewhat dated source for review articles and special information on particular enzymes. There are 14 pages of superfluous introduction, which could have been replaced easily by a single-page description of the format. The only physicochemical property listed is molecular weight. This is available for less than half of the enzymes, and for many of these the method and conditions of determination are either totally or partially omitted. The rest of the enormous quantity of data is kinetic information. The information is very heterogeneous, ranging from a simple statement on specificity for a number of enzymes to a single Michaelis constant (conditions not given) to a selective list of 19 (out of at least 100 known) substrates for chymotrypsin A complete with k_0's and K_m's to a list of 30 substrates for D-amino acid acetyltransferase with relative velocities. The light-absorption data refer only to the substrates, not the enzymes. No assay methods or isolation procedures are listed, and in many instances essential cofactors or coenzymes have not been mentioned.

Perhaps the most important consideration regarding a compilation of this sort is whether or not the data that have been selected are reliable and representative. This reviewer noted several errors of omission and commission concerning certain enzymes with which he is most familiar. No attempt was made to ascertain the extent of such shortcomings, and they might be fortuitous. Nevertheless, they indicate that one must view the data with certain reservations.

The handbook can be helpful to a sizable number of readers. For beginners it would certainly be a convenient starting point for collecting references, and for veteran enzymologists it is the best listing of enzymes available. Since it is already out of date with regard to many of the citations and may be under revision for a second edition, it might be worthwhile considering a loose-leaf version in the style of the Worthington or Boehringer manuals, which are more informative though obviously limited in scope.

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Resonances in Nuclei

Shell-Model Approach to Nuclear Reactions. CLAUDE MAHAUX and HANS A. WEIDENMÜLLER. North-Holland, Amsterdam; Interscience (Wiley), New York, 1969. xii + 348 pp., illus. $16.

In the past five years the shell-model approach to reaction theory has revived interest in this area of both atomic and nuclear physics. Wedding the shell model for bound states and the distorted-wave Born approximation for reaction amplitudes, this approach provides a new insight into the origin of resonances in both atoms and nuclei. Resonances are attributed to the decay of discrete states of an independent-particle Hamiltonian. These states are formed by exciting two or more particles to bound orbitals whose total excitation energy exceeds the binding energy of a particle in the ground state. The residual two-particle interaction enables these states to decay by particle emission, but their transient existence is reflected in resonances in elastic and inelastic processes.

A large number of papers have developed these ideas, clarified various new concepts associated with this approach, such as "doorways," developed techniques for handling difficulties introduced by narrow single-particle resonances, and presented the results of calculations. In this monograph the authors undertake to review this work and to give some assessment of it. Almost every significant paper on the subject has been referenced and their bibliography lists every citation of each paper. Nevertheless the bulk of the material in the monograph is taken directly from the authors' own papers. The reader is therefore well advised to remember that this is a book in which the judgments and conclusions are closely related to the authors' own research.

Topics include various formulations of the shell-model approach, approximation schemes for solving the equa-

tion, and numerical calculations. An interesting comparison is given between the shell-model approach with scattering states and an R-matrix version of the model. Some new material appears in a discussion of the optical model, the coupled-channels approach, and the distorted-wave theory. An important application of the theory is the discussion of fine structure in nuclear resonances. Slightly less than one-third of the book is devoted to this subject. Most of the authors' important contributions have been made on this subject. These are presented in considerable detail.

The general tone of the book is rather formal. Each development is given in complete mathematical detail in a rather extended notation. Operators or matrix algebra have been eschewed so that all equations are explicit, to anyone who can keep the symbols in mind. Unfortunately this style also makes for rather tedious reading. Some refinements in notation and abbreviation of the derivation would have made the monograph more accessible without decreasing its usefulness. Some judicious pruning would also have allowed for more discussion of other important developments, such as the comprehensive theory of Lane and Robson, and of other numerical calculations. Nevertheless, this monograph will prove essential as a guide to a new approach to nuclear reactions which is still in the forefront of research.

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Electromagnetic Scattering

The Scattering of Light and Other Electromagnetic Radiation. MILTON KERKER. Academic Press, New York, 1969. xviii + 670 pp., illus. $33.50.

The study of electromagnetic scattering, an old subject, has had a revival in recent years. This is partly a consequence of the availability of computers, which have permitted numerical evaluation of the formidable algebraic series arising in the rigorous scattering theory, and partly because of the motivation of application of the theory to such diverse problems as the study of particle size distributions in commercially important colloidal dispersions, radar meteorology, astrophysics, and studies of sizes and shapes of large molecules in solution. Van de Hulst's treatise *Light Scattering by Small Particles* (Wiley, 1957) was very welcome, but the need has persisted for a more comprehensive treatment including a review of recent numerical techniques and applications. Kerker has made a notable contribution toward filling this need.

The interesting historical approach to the development of scattering theory makes for good reading and places the important contributions of Rayleigh, Debye, Lorenz, and Mie in their proper perspective. The reader looking for a detailed mathematical formulation of scattering theory will be disappointed. The techniques and key equations are critically presented, and adequate references and evaluations are given so that the discerning reader will be guided to important source material.

Although the author indicates that the book reflects his bias as a physical chemist and strongly emphasizes applications to colloidal systems, the treatment is quite general and should prove valuable to workers in many areas. Treatment of multiple and inelastic scattering is excluded, the latter omission representing a major gap in consideration of the exciting studies of Brillouin scattering, Doppler shifts, and Raman scattering that have been stimulated by the availability of laser sources. In order to keep the length of the book reasonable, the author wisely omits extensive discussion of experimental procedures.

About two-thirds of the book is devoted to the rigorous treatment of the scattering by uniform and stratified spheres, cylinders, and discs, with emphasis on the interpretation of theory and numerical procedures. Good tabular summaries of available calculations of scattering functions are given, with excellent documentation. Especially valuable in this interdisciplinary subject are the tables comparing notation used by various workers. The chapter on particle size distribution has a good evaluation of the "inverse problem" of calculating the distribution from experimental data.

The chapter on "Rayleigh-Debye scattering" (more commonly called Rayleigh-Gans scattering) presents a compact but comprehensive summary of the limitations of this approach and its applications to macromolecular solutions, colloidal suspensions having small refractive-index ratio, and heterogeneous solids. Small-angle x-ray scattering is well integrated with light scattering here. Extensions to anisotropic systems and the correlation function approach are surveyed.

The effects of density, concentration, and orientation fluctuations in both low and high molecular-weight binary and multicomponent liquids and solutions, critical opalescence, depolarization of scattering by anisotropic objects, and the effect of orientation by shear, electric, and magnetic fields are discussed in the last two chapters.

The book is an excellent reference work both for the beginner who wishes to survey the field and for the advanced researcher who desires an up-to-date key to the literature on electromagnetic scattering.

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Books Received

Abiogenesis. From Molecules to Cells. Paul D. Thompson. Helen Hale, Ed. Consultant. Illustrated by Mary Lybarger. Lippincott, Philadelphia, 1969. 192 pp., illus. $4.95. Introducing Modern Science.

Advances in High Pressure Research. Vol. 2. R. S. Bradley, Ed. Academic Press, New York, 1969. x + 282 pp., illus. $12.

Aftosa. A Historical Survey of Foot-and-Mouth Disease and Inter-American Relations. Manuel A. Machado, Jr. State University of New York Press, Albany, 1969. xvi + 184 pp. $10.

Air Quality Criteria for Sulfur Oxides. National Air Pollution Control Administration, U.S. Department of Health, Education, and Welfare, Washington, D.C., 1969. xvi + 368 pp., illus. Paper, $1.50. National Air Pollution Control Administration Publication No. AP-50.

Applied Solid State Science. Advances in Materials and Device Research. Vol. 1. Raymond Wolfe and C. J. Kriessman, Eds. Academic Press, New York, 1969. xii + 404 pp., illus. $15.

Australian Academy of Science Year Book, 1969. Australian Academy of Science, Canberra, 1969. 116 pp.

Background to Migraine. Second Migraine Symposium, London, Nov. 1967. Robert Smith, Ed. Springer-Verlag, New York, 1969. xii + 88 pp., illus. $3.80.

Biochemical and Clinical Aspects of Alcohol Metabolism. A symposium, Detroit, April 1968. Vishwanath M. Sardesai, Ed. Thomas, Springfield, Ill., 1969. xiv + 322 pp., illus. $27.

The Biologic Effects of Ultraviolet Radiation (With Emphasis on the Skin). Proceedings of the Congress of the International Society of Biometeorology, New Brunswick, N.J., August 1966. Frederick Urbach, Ed. Pergamon, New York, 1969. xvi + 704 pp. + plates. $38.

The Bowl of Night. The Physical Uni-

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