REVIEWS

Thermodynamics and Statistical Mechanics (*Lectures on Theoretical Physics*), Vol. V. By Arnold Sommerfeld. Edited by F. Bopp and J. Meixner. English translation by J. Kastin. (Academic Press Inc., New York), 1956. Pp. xi + 401. Price $ 7.00.

Sommerfeld occupies a unique place amongst the great masters of theoretical physics of this century. For lucidity of expression and perspicacity of treatment, he has few rivals. He always places the greatest stress on physical insight, and the mathematics used is simple and appropriate, and is not allowed to becloud the physics under discussion. Six volumes in the series have so far appeared: *Mechanics* (1952); *Mechanics of Deformable Bodies* (1950); *Electrodynamics* (1952); *Optics* (1954); *Thermodynamics and Statistical Mechanics* (1956); *Partial Differential Equations in Physics* (1949).

It is a matter of extreme regret that Sommerfeld did not live to complete his series on theoretical physics. He died (due to a road accident) while he was still working on the volume under review. Chapter V of the book has been written by the Editors. (The original German edition appeared by the end of 1952.)

The book contains five chapters entitled: (*i*) Thermodynamics: General Considerations; (*ii*) The Application of Thermodynamics to Special System; (*iii*) The Elementary Kinetic Theory of Gases; (*iv*) General Statistical Mechanics: Combinatorial Method; and (*v*) Outline of an Exact Kinetic Theory of Gases. At the end of the book, about ten pages of problems and hints for solution are provided. There is a reasonably complete index.

Chapter I deals with the laws of thermodynamics, thermodynamic relations and potentials, Joule Thomson Effect, and Properties of Van der Waals Equations. The chapter begins with the zeroth law (existence of temperature) and concludes with an excellent treatment of the Nernst heat theorem and the unattainability of absolute zero of temperature. It seems a little unfortunate to the reviewer that the concept of quantity of heat is introduced 'intuitively' rather than 'logically'. A brief description of Carathéodory's proof of the *Second Law* is also given. There is an interesting and very instructive sub-section on the relative rank of energy and entropy. It is largely based on Robert Emden's note to *Nature* (1938) which does not appear to be as widely known as it should be. Emden writes: "I fetch a bottle of claret from the cold cellar and put it to be tempered in the warm room. It becomes warmer but the increased energy content is not borrowed from the air of the room but is brought in from outside."

Chapter II deals with the applications of thermodynamics to gaseous mixtures and dilute solutions, phase equilibria, galvanic cells and backbody radiation. There is a section on magnetic effects. The last section deals with the thermodynamics of non-equilibrium processes. Onsager's reciprocal relations are described, and the limitations of the theory of irreversible processes are also discussed.

Chapter III deals with the properties of Maxwellian gas (classical gas) and gives an elementary account of the theory of transport phenomena. Chapter IV gives an account of Boltzmann's Combinatorial method in statistical thermodynamics. The method of the most probable state and also the Darwin-Fowler's method of saddle point integration are given. The chapter also discusses the theory of specific heat of gases and solids. A brief account is given of the Bose-Einstein and Fermic-Dirac statistics with an excellent introduction to the electron theory of metals. There is a very interesting section on the theory of fluctuations.

Chapter V gives an outline of an exact kinetic theory of gases. Starting from Maxwell-Boltzmann's collision equation, we pass on to the H-theorems and then follow the fundamental equations of fluid dynamics. The last section is concerned with conductivity and Wiedemann-Franz Law.

All in all this is a splendid book. In fact, one could hardly think of a more lucid and stimulating introduction to thermodynamics and statistical mechanics than what is provided here. There can be no doubt that the book would be found extremely useful and instructive for the B.Sc. (Hons.) and post-graduate classes, and also for those who intend to specialise in this subject.

D. S. KOTHARI.

Numerical Analysis. By Z. Kopal. (Chapman & Hall, London), 1955. Pp. xiv + 556. Price 63 *sh.*

This is a very comprehensive book on the subject of numerical analysis. The author, now

Professor of Astronomy at Manchester, had been lecturing on this subject at the M.I.T. and the book is the outcome of these lectures. It presents in a very clear manner not only the theoretical aspects, but contains a large number of numerical examples, besides a number of problems appended to each chapter. There is also a bibliographical note at the end of each chapter, in which are given references to the original literature, as well as suggestions for further reading.

The volume starts with an introductory historical survey dating from the origin of the concept of number in the ancient times and contains seven other chapters dealing with polynomial interpolation, numerical differentiation, integration of ordinary differential equations, boundary valve problems, quadrature formulæ and numerical solution of integral and integro-differential equations. A number of appendices containing tables of data for interpolation and other processes are added at the end.

Unfortunately, the book does not deal with solution of linear simultaneous equations, computation of determinants and numerical methods of harmonic analysis and Fourier synthesis which are of great interest to the physicist, although an appendix gives a list of references on the first topic. This is probably because the emphasis is on "The Application of Numerical Techniques to Problems of Infinitesimal Calculus in Single Variable", as stated in the subtitle to the book.

The volume will be found useful by all classes of readers, from the under-graduate beginners who wish to learn the subject to the researcher in applied mathematics, who would find it an excellent reference book.

Physical Techniques in Biological Research, Vol. I. (*Optical Techniques.*) Edited by G. Oster and A. W. Pollister. (Academic Press Inc., New York), 1955. Pp. xi + 5. Price not given.

During recent years, the line of demarcation between physical and biological sciences has tended to become more and more indistinct. Physicists and chemists have attempted to use their techniques for the study of biological systems and biologists themselves have felt the need for accurate physico-chemical studies for a complete understanding of their subject. The appearance of this series of volumes devoted to the applications of physical methods in biology is therefore particularly welcome.

Volume I deals with optical techniques, including electron microscopy. The topics dealt with are photochemistry and luminescence, visible, ultraviolet and infrared spectroscopy; light scattering and birefringence; the microscope, including phase contrast methods; electron microscopy. Each article is written by a specialist, particularly familiar with that subject, a feature which has become very common in recent books. The articles are all written with an emphasis on the needs of the biologist rather than that of the physicist. Aspects of instrumentation are particularly well stressed and although the main steps in the interpretation of the data are pointed out, the physicist is left somewhat unsatisfied with the theoretical parts. The results of the theories are clearly and analytically discussed, but it would have been worthwhile to have considered briefly also the basic assumptions in the theories. But for this minor omission, all the articles give excellent accounts of the present state of knowledge in each field and there is no doubt that they would help in increasing the rate at which these techniques are applied in biological problems.

The volume can be warmly recommended to all interested in biophysics. The appearance of Volumes II and III dealing with physical chemical techniques and cells and tissues respectively would be looked forward to with great interest.

G. N. RAMACHANDRAN.

Chemistry of Carbon Compounds, Vol. III. (*Aromatic Compounds*), Part B. Edited by E. H. Rood. (Elsevier Publishing Co.), 1956. Pp. 687-1670. Price £ 8 10. *sh.*

This is a further addition to the important series dealing with organic chemistry. Volume III is allotted for aromatic compounds having homocyclic rings. In Part A was given a description of the simpler derivatives of benzene. More complex types are dealt with in Part B which also completes the account of benzene derivatives. A large number of well-known and experienced organic chemists have written the chapters. Excellent accounts are found on many topics of current interest such as quinones including naphthaquinones and athraquinones, azulenes, isocoumarins, tannins and depsides. Owing to restrictions of space, many of them are dealt with rather briefly, but the literature cited enables the reader to obtain detailed information. The chapter on monocyclic quasi-aromatic compounds is particularly interesting. It gives a good description

of tropolones including tropylium salts, and derivatives of cyclopentadiene including a detailed account of the highly interesting iron compound, ferrocene.

The later portions of the book are devoted to aromatic compounds containing a number of benzene rings and belonging to various types such as anthracene, phenanthrene, fluorene, acenaphthene and polycyclic compounds. Though there are occasional errors of minor nature that have escaped notice, the treatment of the various topics is uniformly good; the literature references are very useful and the index is extensive. The volume constitutes therefore another welcome addition to the library of both the teacher and the student of organic chemistry.

T. R. S.

Enzymes and Metabolism. (Elsevier Publishing Company, New York), 1956. Pp. 287. Price 47 *sh.* 6 *d.*

The book is a collection of papers dedicated to Carl F. and Gerty T. Cori on the occasion of their 60th birthday, the original edition of the book having appeared as an issue of *Biochemica et Biophysica Acta*, Volume 20, No. 1, 1956. At least one of the authors of every paper was either Coris' former student or associated with the Cori Laboratory. Their scholarly contributions reflect in a large measure the high standards of excellence instilled in the authors by their teacher and/or associate. The introductory article about the life and achievements of the Coris, written by B. A. Houssay who shared with them the Nobel Award for physiology and medicine in 1947, is a thrilling story which bears evidence of their rare imagination and experimental rigour throughout an extraordinarily busy life lived in conformity to the highest scientific traditions.

There are thirty-two papers in this volume, most of them pertaining to several aspects of carbohydrate metabolism to the progressive understanding of which the contributions of the Coris proved invaluable. The articles on the molecular weights of some crystalline enzymes from muscle and yeast, on galactosemina as a congenital defect in a nucleotide transferase and on the mechanism of antibody-antigen reaction, to mention only a few, serve as pointers to indicate the vast progress made in the understanding of enzymatic processes during this decade and the exciting truths that remain to be unravelled in the future. The editors have done a nice job in the selection of articles and their arrangement to justify the title. The inclusion of articles such as 'the biosynthesis of DNA in the bone marrow and neoplastic cells', the 'enzymatic synthesis of polynucleotides', 'formation of purines and RNA in Baker's yeast', etc., is to be appreciated since some of them demonstrate the interlinking of carbohydrate, amino acid and nucleic acid metabolism.

This method of bringing forth volumes dedicated to pioneers in science on occasions like this is indeed worth emulating. This handsomely bound volume is well printed on fine paper, and the photographs and figures are especially well reproduced.

K. V. Giri.

Some Protozoal Diseases of Man and Animals, Anaplasmosis, Babessiosis and Toxoplasmosis. By C. Cole and 19 others. (*Annals of the New York Academy of Sciences*), 1956. Vol. 64, Art. 2. Pp. 25-277. Price $ 3.5.

The incidence and epidemiological aspects of many protozoan diseases affecting man and animals still need elucidation. Research carried out in certain parts of U.S.A. and Europe on the prevalence of Anaplasmosis, Babessiosis and Toxoplasmosis and presented in this volume, stress the need for an investigation on a global scale. These should be studied by veterinarians and public health authorities interested in the preservation of the cattle wealth of the country and adoption of public health measures to eradicate the spread of the disease to human population.

Anaplasmosis is an infectious disease of the cattle caused by *Anaplasma margniale.* Field surveys have shown the prevalence of the disease in nearly 45% of the cattle in certain areas of U.S.A. The essential features of this disease are presented in Part I. The need to diagnose the disease even in the absence of the parasite in the blood, the status of complement fixation test as regards its accuracy, and specificity, the still doubtful probable relative role of the flies, mosquitoes and ticks as natural transmitting agents are presented in a concise manner. The absence of a suitable screening test for a study of chemotherapeutic drugs has handicapped large-scale trials. Oxytetracycline and chlorotetracycline are mentioned as the only drugs exhibiting slight suppressive action.

A discussion on the piroplasma of domestic animals and their worldwide incidence constitutes the second part. An exhaustive survey of the literature pertaining to the classification, transmission and biology of piroplasma and the complexities involved in the immunological phenomenon is a notable feature of this section. The lists given will be of value to veteri-

narians engaged in the control of tick-borne disease and to zoologists occupied in systematic classification. The biological approach is an interesting feature for chemotherapeutic research. The atypical manifestation as exemplified by the ocular, respiratory, digestive, nervous and rheumatic symptoms indicate the difficulties to be encountered in the diagnosis in the absence of the demonstration of the parasite.

The third and the last part deals with Toxoplasmosis. The association of this protozoal infection with human disease has led to extensive research resulting in the recognition of its widespread prevalence both in the human and in animals. The propagation and morphology of the protozoan including electron microscopy studies, biological aspects dealing with epidemiology, propagation by tissue culture techniques, host range among mammals, modes of transmission, course of infection, diagnostic procedures, congenital human toxcplasmosis and dynamics of pathogenesis have been dealt in a comprehensive manner. The discussions on the organisms resembling toxoplasma, on the nomenclature of *Besnoitia besnoiti* and transmission of *B. jellisoni* by ingestion are highly informative.

M. SIRSI.

Elements of Geology (Third Edition). By E. de C. Clarke, R. T. Prider and C. Teichert. (Revised by R. T. Prider.) (The Western Australia Press, Nedlands, Western Australia), 1955. Price 40 *sh.*

This book deals with the general principles of geology in three sections, with illustrations from Western Australia. In the introductory section are given definitions, general characters of the earth, the divisions of geology and its relation to the other sciences. Then follow an account of the work of pioneer geologists of Western Australia and the outline of the growth of knowledge of the geology of the country. In the section on physical geology, an account is given of the general constitution of the lithosphere rocks and minerals, and a detailed account of igneous rocks. Then follows an account of atmosphere-weathering and the constructive and destructive work of wind. An examination of the action of rivers, river development, underground water, ocean and lakes, glaciers and icebergs, and the action of organisms are all dealt with in detail. A chapter each is devoted to sedimentary rocks, earth movements and metamorphism. The one on earth movements also includes an account of folding, jointing, faulting, and diastrophism, while the chapter on metamorphism also deals with such modern concepts as granitization. In the section on historical geology, the several systems are described with an account of their characteristic rock formations and fossils.

The various chapters are copiously illustrated with examples from Western Australia, as the book is primarily intended for students of Western Australia. But every chapter contains first statements of general principles of geology, and these are so lucidly and concisely stated that every student of geology in any country will find the book an excellent introduction to the subject of geology.

P. R. J.

Books Received

Aureomycin (Chlortetracycline). Antibiotics Monographs No. 7. By Mark H. Lepper. (Published by Medical Encyclopædia, Inc., New York), 1956. Pp. 156. Price 5.00.

Transactions of the Symposium on Partial Differential Equations held at the University of California at Berkeley, June 20-July 1, 1955. Edited by A. Aronszajn, A. Douglis and C. B. Morrey, Jr. (Interscience Pub.), 1956. Pp. vi + 334. Price $ 6.50.

Organic Analysis, Vol. III. Edited by John Mitchell, Jr., I. M. Kolthoff, E. S. Proskaur and A. Weissberger. (Interscience Pub.), 1956. Pp. viii + 546. Price $ 11.50.

Sperm Whales of the Azores. By Robert Clarke. (*Discovery Reports,* Vol. 28. Pp. 237-298.) (Cambridge University Press), 1956. Price 27 *sh.* 6 *d.* net.

Sir Richard Gregory—His Life and Work. By W. H. G. Armitage. (Macmillan & Co.), 1957. Pp. 241. Price 21 *sh.*

The Amphibia of Ceylon. By P. Kirtisinghe. (Published by the Author, Dept. of Zoology, University of Ceylon, 2, Charles Circus, Colombo 3), 1957. Pp. xiii + 112. Price not given.