

The third chapter by E. A. Barnard and W. D. Stein deals with the role of imidazole in biological systems. This chapter is a very valuable summary of presently available information, much of which is critically evaluated. The specific catalytic role of imidazole groups in reactions involving acylation, phosphorylation and hydrolytic cleavage is stressed. The present difficulties in making positive identification of imidazole as an active center in a given enzyme are examined, and a suggestion is made for obtaining a new type of more specific imidazole-blocking group. The chapter is on the whole well written, but there are occasional points of slight obscurity.

The fourth chapter on uridine diphosphogalactose by H. Kalckar in substance constitutes a very good review of the role of this material in enzymatic reactions. The review is marred, however, by a rather poor style and instances of obscurity and unacceptable grammar.

The fifth chapter on the substrate and mode of action of neuraminidase by A. Gottschalk is a short but informative section on the occurrence and action of this enzyme and the nature of the substrates upon which it acts. The use of the word *terminal* in referring to the position of attachment of sialic acid to polysaccharide may be misleading, since the sialic acid residues seems to occur in multiple sites as terminal branches, and not solely as terminating groups at the end of polysaccharide chains.

The sixth chapter on the constitution of the respiratory chain in animal tissue by E. C. Slater treats the subject of biological oxidation in animal tissues. The major purpose of the presentation is stated to be a consideration of evidence for new components in the respiratory chain located in the mitochondria. The exposition stresses the past and present views of the author. The citations from the literature are incomplete and the article is probably more suitable for the specialist than for the non-specialist.

The seventh chapter on the enzymology of the plastids by N. M. Sissakian should have received much more careful editing. The English is poor. Some of the discussion is very vague; for instance there is no clear statement concerning the location of the enzymes of the Krebs tricarboxylic acid cycle in plant cells. An illustration of what seems to constitute inadequate standards on the part of the author is the inclusion of eight electrophoretic diagrams which in the opinion of the reviewer contribute absolutely no information. On the whole, this chapter does contain some worthwhile material but is not of a high standard of excellence.

The eighth chapter on enzymatic transformation of steroids by microorganisms, by E. Vischer and A. Wettstein, is a well written and excellent review, informative and comprehensive. The various steroid transformations catalyzed by microbial enzymes are listed. The enzymes themselves are discussed, and a little is said about reaction mechanisms. The authors state their hope that the chapter will stimulate interest in the purification of some of the enzymes that are mentioned.

The ninth chapter on the mechanism of hydrolysis by choline esterases and related enzymes by D. R. Davies and A. L. Green is a well-written summary of present day knowledge of the field. Some new mechanisms are proposed by the authors, who may be somewhat arbitrary however in setting up a list of the facts that they believe must be explained by any proposed mechanism for hydrolysis by esterases. The particular mechanism suggested by them for esterase hydrolysis may be somewhat too complex.

The tenth chapter on the biosynthesis of dicarboxylic amino acids and enzyme transformations of amides in plants by W. L. Kretovitch is for the most part readable and informative, although the English style is not excellent. Some of the tables are very poorly set up, and in one or two cases the data are so meagre as to make questionable their inclusion in a table at all. The interesting hypothesis of Steward and Thompson concerning a possible ring form for asparagine is mentioned and it is suggested that the occurrence of this molecular species may account for the fact that the metabolic activity of asparagine is generally lower than that of glutamine. Although the references to non-Russian papers may be incomplete, the inclusion of a very large number of Russian references is to be commended, since these often are overlooked in Western countries.

The eleventh chapter on pectic substances and pectic enzymes by H. Deuel and E. Stutz is relatively well written,

informative and comprehensive. An addendum has been added to bring the work up-to-date insofar as possible.

The twelfth chapter on antibiotics and plant diseases contains much interesting material on the use and attempted use of antibiotics to control diseases of plants and to fight spoilage of harvested crops, such as potatoes. The chapter will undoubtedly be of considerable value to those interested in this new application of biochemistry. The review is well written, informative and apparently quite comprehensive.

When viewed in its entirety this volume certainly suffers from a lack of editing. There are many instances of poor construction, poor style and bad grammar. The ludicrous error occurs of using *urinediphospho galactose* instead of *uridine diphosphogalactose* as a running title. In the case of a work composed by a cosmopolitan group of authors, for many of whom English presumably is not the mother tongue, more care should be taken by the editor in smoothing out the rough spots and removing at least the most glaring mistakes. It can be stated however that this volume will be of general interest to all biochemists and a worthwhile addition to the libraries of those particularly interested in enzymology.

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Number-Average Molecular Weights. Fundamentals and Determination. By ROBERT U. BONNAR, MARTIN DIMBAT and FRED H. STROSS, Shell Development Company, Emeryville, California. Interscience Publishers, Inc., 205 Fifth Avenue, New York 1, N.Y. 1958. x + 310 pp. 16 × 23.5 cm. Price, \$7.50.

As is indicated by the title, this book is concerned with a discussion of the theory and experimental methods that are employed to determine the number average molecular weights of a variety of chemical substances. An introductory chapter surveys the various methods available and discusses very briefly the advantages and disadvantages of each. The methods discussed are cryoscopic, ebullioscopic, osmotic pressure, lowering of the vapor pressure, gas density and functional group analysis. An individual chapter is devoted to a more detailed discussion of each method and one chapter is concerned solely with a theoretical discussion of the calculation of molecular weight when using the cryoscopic or ebullioscopic methods. About eighty-five per cent. of the book is devoted to a discussion of the ebullioscopic, cryoscopic and osmotic pressure methods with the other techniques receiving proportionately less attention.

The limitations of each of the primary methods are presented, particularly the molecular weight ranges that can be covered. The various types of equipment that can be utilized and that are available are considered. Thus, for example, five different types of osmometers are considered in detail and the advantages and disadvantages of each are discussed. In this and the other techniques emphasis appears to be given to designs which allow for rapidity of measurements. The major merit of this book and a very significant contribution indeed, lies in the detailed discussion and analysis of experimental procedures and possible sources of error. The latter consideration involves discussion of the more obvious sources of error and the equally important more subtle ones. Procedures are given as to how these errors can be systematically detected and in many instances advice is given as to how they can be avoided. These descriptions will be of invaluable aid to the experimentalist working in this field.

Characteristic of the methods used to determine molecular weights is the fact that though all measurements are made at finite concentrations, it is inevitable that extrapolation be made to infinite dilution to determine the required quantity, unless one is dealing with an ideal solution. Although some consideration is given to the theory of non-ideal solutions and references are given to the more standard texts on the subject, major emphasis is focused on the statistical methods of data analysis. Though the contribution of statistics in analyzing the reliability of data is well recognized, the appropriate more detailed thermodynamic analyses may be of more importance to the problem. The suggestion by the authors that the Flory-Huggins formulation be used to express the activity of the solvent in dilute solutions should be taken cautiously as it is known to be inapplicable in most dilute polymer solutions.

This book is clearly and concisely written with a large but carefully selected number of figures. Particularly commendable is the fact that the instrument illustrations are accompanied by a very clear description in the text so that the functioning and design of a given piece of equipment can be easily followed and understood. This book should be heartily welcomed by workers in the field, particularly those who have assumed the experimental responsibility of determining number-average molecular weights and related thermodynamic properties.

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Annual Review of Nuclear Science. Volume 8. EMILIO SEGRÈ, Editor, University of California, GERHART FRIEDLANDER, Associate Editor, Brookhaven National Laboratory, and WALTER E. MEYERHOF, Associate Editor, Stanford University. Annual Reviews, Inc., Grant Avenue, Palo Alto, California. 1958. vii + 417 pp. 16 × 23 cm. Price, \$7.00 (U.S.A.); \$7.50 (elsewhere).

The volumes of "Annual Review of Nuclear Science" have probably become so familiar to most persons interested in pure and applied nuclear physics, that the reviewer might dispense with a general description of the character of this series. For the few uninitiated readers, it may be stated that each volume contains a collection of about a dozen articles, with a balanced distribution between pure nuclear physics and its applications to chemistry, biology, geology, etc. No effort is made to cover every year advances in all branches of nuclear science. The much more opportune procedure followed is to review each year those fields where a considerable amount of knowledge has accumulated since the last review appeared in this series or elsewhere, and therefore it is desirable that the present status of the problem be summarized. In the past such articles have proved invaluable both to the specialist in deciding the direction of his future investigations, and to the person wishing to survey a field close to but not exactly his own. One feature that greatly enhances the value of these books, and for which editors and authors must be congratulated, is the short time elapsing between the appearance of results in the technical papers and their coverage in these reviews. In the present volume, literature up to the spring of 1958 (about 6 months before the appearance of the book) is fully taken into account, and even data personally communicated to the authors and still unpublished at that time are included.

The volume opens with a high-caliber article of a theoretical nature, *Invariance principles of nuclear physics* by G. C. Wick. Parity, charge conjugation, time-reversal, charge independence, baryon and lepton conservation, and strangeness are discussed. These problems are viewed from the vantage point of the field-theoretical methods of quantum mechanics, and the treatment is masterful in its clarity and completeness. In contrast to many articles on parity non-conservation and related subjects that have appeared elsewhere, this is definitely not an elementary approach for the uninitiated.

The optical model and its justification, by H. Feshbach, covers the principles and applications of a method for reducing many problems of nucleon-nucleus interaction to the study of a two-body system. The article is excellently written and condenses material previously scattered in numerous and lengthy papers.

Hyperfragments, by W. F. Fry, is a brief but comprehensive account of the properties of light nuclei where a neutron is replaced by a lambda-zero hyperon. These peculiar objects supply valuable information on strange-particle interactions.

Antinucleons by E. Segrè is a clear and authoritative account of the discovery and properties of these constituents of "antimatter."

Gamma-ray spectroscopy by direct crystal diffraction, by J. W. M. DuMond, is an excellent review of the work done by the author (who spent a life-time in perfecting high-resolution X-ray and gamma-ray spectrometers) and by a few others who have undertaken these difficult experiments. This technique of measuring gamma-ray wave lengths, while requiring exceptionally strong sources, supplies a precision unequalled by any other method. A large number of lines

have been determined, which will serve the same purpose as standard wave lengths in optical spectra.

Conceptual advances in accelerators, by D. L. Judd, is a compact but complete summary of the principles involved in the design of the present accelerators and of the ideas advanced, in this country and elsewhere, to improve attainable energy, current intensity, accessibility of the beam, length of duty cycle, and other desirable features. The alternating-gradient focusing has been the greatest advance of the past few years; intersecting-beam accelerators to attain higher useful particle energies, and use of plasma to increase current intensities, are some of the ideas that have been proposed, but their practical application seems rather remote.

The primary cosmic radiation, by H. V. Neher, describes the chemical composition of the primary cosmic-ray particles in relation to the abundance of nuclear species in the universe. The energy distribution and the suggested mechanisms of cosmic-ray acceleration also are discussed.

The radioactivity of the atmosphere and the hydrosphere, by H. E. Suess, describes recent determinations of tritium, C¹⁴, and other radioactive elements, either liberated from radioactive elements in the earth, produced by cosmic-ray interactions in the atmosphere, or introduced by man's nuclear explosions.

Geochronology by radioactive decay, by L. T. Aldrich and G. W. Wetherill, deals with a subject that had been reviewed in this series only 4 years ago. The necessity for a new summary emphasizes the progress realized in this brief period. The potassium and rubidium methods, in their infancy at that time, now rival the uranium-lead methods in accuracy and are of much more general application as they involve common elements. Excellent consistency exists on the ages of many pre-Cambrian igneous rocks. On the other hand, no progress has been made on the important task of pegging the conventional geologic time-scale, from the Cambrian to the Recent, to absolute, radioactively determined dates. Geologists still rely on a few points, determined many years ago and open to question. A massive attack on this problem is urgently needed. The present article deals essentially with the methods of age determination rather than their geological implications.

Nuclear astrophysics, by A. G. W. Cameron, is a most interesting account of our present knowledge of nuclear reactions going on in the stars, in relation to the origin and abundance of the various nuclear species.

Practical control of radiation hazards in physics research, by B. J. Moyer, should prove useful to many nuclear physicists, chemists, etc., whose notions about the dangers of exposure to radiations seem generally rather vague, if the reviewer and his associates can be taken as examples.

The purpose of cellular radiobiology, by T. H. Wood, is, in the author's words, "a review of those papers published in 1957 that deal with the effects of ionizing and ultraviolet radiations on simple biological systems." The large bibliography cited and the frequency of reviews in this field indicate its rapid development. A special topic of this subject, *Information theory in radiobiology*, is the object of a separate, brief article by H. Quastler. It discusses the statistical principles that govern in an organism the macroscopic consequences of the primary radiation effects.

The above summary of the contents of the individual articles clearly shows that the eighth volume of this series is fully as useful as its predecessors to all students of pure and applied nuclear science. The list of authors and topics for the forthcoming 1959 issue will doubtless induce a feeling of keen expectation in all those interested in what probably is the fastest progressing branch of human knowledge.

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Internal Conversion Coefficients. By M. E. ROSE, Chief Physicist, Oak Ridge National Laboratory. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1958. xxi + 173 pp. 23 × 30.5 cm. Price, \$6.25.

The internal conversion of γ -rays supplies a most useful tool to the investigator concerned with unravelling nuclear decay schemes; it also supplies a very nice example, with a fair number of subtle features (some of which have been apparent only in the last couple of years), of the interaction of a system of charged particles with the electromagnetic field.