

applicable) and at the sensitivity of the method (in many cases  $10^{-12}$  gram or better).

The article by Glendenin and Steinberg on Fission Radiochemistry deals with the yields of fission products from various nuclei which undergo fission with neutrons up to a few Mev. in energy or which undergo spontaneous fission. The authors discuss measurements made since 1949, including several determinations of improved accuracy, and work on the fine structure of the curve of fission yield vs. mass number. Their main concern is with details of these fission yield curves and with the modes of charge division in fission.

Manov contributes a paper on the Standardization of Radioactive Sources. After reviewing methods of standardization and improvements in methods, he presents in detail the situation on standard sources now available from the National Bureau of Standards—carbon-14, cobalt-60, iodine-131, phosphorus-32, radium-226, lead-bismuth-210, strontium-90 and thallium-204. He then discusses the nuclear information available on certain other radionuclides which he feels would be desirable standards—gold-198, iron-55, iron-59, sodium-24, tritium, chromium-51 and zinc-65. This article should prove of great value to all who have occasion to make accurate measurements of the strength of radioactive samples. It is, moreover, well and interestingly written.

Another article highly recommended for its general interest is that by Kohman and Saito on Radioactivity in Geology and Cosmology. As the authors point out, the geological ramifications of the occurrence of radioactivity in nature have been growing by leaps and bounds and there is an indication that it will prove convenient to recognize a separate branch of science under the name "nuclear geology." The authors review the properties of the "natural" radionuclides and their occurrence and distribution in nature. They then discuss the occurrence of "induced natural radionuclides"—e.g. carbon-14, tritium, beryllium-7. They thoroughly discuss the application of radioactivity to the measurement of geologic time and review the subject of radiogenic terrestrial heat. They then proceed to more cosmic questions and discuss briefly the "megascopic history of the earth" and the age of the elements and the universe. This is a fascinating article, with a staggering number of 592 references, most of them since 1950.

Perlman and Asaro give a comprehensive and critical presentation of data on alpha decay energies and lifetimes, discuss the systematic trends in these properties, and their relation to nuclear structure—subjects which their group at the University of California has been particularly instrumental in developing. This review will be appreciated by all workers in the field.

A chapter which should interest theoretical chemists is the one by DeBenedetti and Corben on positronium. This atom, composed of a positron and an electron, appears to be a definite, although evanescent, chemical species. Its exceedingly short lifetime is terminated by the mutual annihilation of its constituent particles; the entity is observed and studied through the annihilation radiation. By means of sophisticated counting techniques one can study many of the properties of this unusual atom, for example its *ortho-para* conversion as catalyzed by molecules with an odd electron. There is indication that positronium reacts with  $\text{Cl}_2$  or  $\text{Br}_2$  to form a positronium halide. In connection with these chemical effects, the authors remark "It appears from these studies that the formation and decomposition of positronium is related to the properties of the molecules of the surrounding gas; in a sense, it can be regarded as a chemical problem. . . . It would seem natural that the work should be continued by chemists, to whom positronium should present the challenge of a new element whose chemical properties have to be classified; and owing to its extreme simplicity, it may be an element of particular value for the understanding of the mechanism of chemical reactions and for the study of the nature of the chemical bond."

The other articles in the volume will probably be of less interest to chemists than those aforementioned. A series of three papers on nuclear particle detection (R. E. Bell; R. K. Swank; and J. Marshall) does, however, contain fascinating information on fast electronic circuits, characteristics of scintillator detectors for ionizing radiation, and on the use of Čerenkov radiation from high speed charged particles as a detection method. There are articles on Theories of Photonuclear Reactions (Levinger), Interac-

tions between  $\pi$ -Mesons and Nucleons (Gell-Mann and Watson), Heavy Mesons (Dilworth, Occhialini, and Scarsi), and on the Penetration of Heavy Charged Particles in Matter (Uehling) most of which the reviewer found fairly hard going because of their theoretical language. The last mentioned, however, may repay the attention of those who are concerned with the chemical effects of ionizing radiations. Finally, there are two papers on Biochemical Effects of Radiation (DuBois and Peterson) and Vertebrate Radiobiology (J. F. Thomson) on which the reviewer feels unqualified to comment except to say that one's impression is that progress is being made, that a multitude of observations are being accumulated at a bewildering rate, and that there are many apparent contradictions and many matters of principle still to be resolved.

As to the readability of the various contributions, there continues to be some spread in the clarity, elegance, and general quality of exposition. However, this is doubtless unavoidable with such a large collection of topics and writers; and one cannot help but feel grateful to the authors and editors for their efforts in preparing this useful volume.

DEPARTMENT OF CHEMISTRY  
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**Outline of Enzyme Chemistry.** By J. B. NEILANDS, Department of Biochemistry, PAUL K. STUMPF, Department of Plant Biochemistry, and ROGER Y. STANIER, Department of Bacteriology, University of California, Berkeley, California. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. x + 315 pp.  $15.5 \times 23.5$  cm. Price, \$6.50.

The authors, in introducing this book as an introductory text in enzyme chemistry for beginning graduate students and research workers in fields other than enzymology, have wisely avoided the mistake of writing a broad coverage of enzymes. They have rather stressed the fundamentals, and the first half of the book is devoted to general properties which can be applied to enzymes generally.

The book is divided into four sections with twenty-five chapters. The first section is devoted to an introduction and general fundamental principles, including such topics as the history of enzyme chemistry, equilibria and ionization, isolation, purity criteria and characterization methods. The three chapters on isolation methods, criteria of purity and characterization are both well written and properly emphasized in this introductory text. Section 2 concerns a treatment of the physical chemistry of enzymes. The chapters are devoted to a classical but concise coverage of kinetics, action of inhibitors, effect of temperature, pH, energetics, oxidation-reduction and enzyme-substrate compounds. These topics which are frequently difficult for beginning graduate students are simplified and easy to follow. Part 3 classifies and describes types of coenzymes and enzymes. The authors have summarized the suggestions of a diverse group of enzymologists over the past few years in compiling a meaningful, timely, and useful classification system. One chapter is devoted to the discussion of respiratory enzymes. Part 4 deals with a study of the metabolic problems at the enzyme level. Some of the more classical metabolic systems are reviewed: glycolysis, hexose monophosphate shunt, tricarboxylic acid cycle, as well as oxidative phosphorylation and fatty acid oxidation. The last chapter by Roger Stanier on the synthesis of enzymes covers an area which cannot be ignored in modern enzymology. This excellent coverage serves as an ideal introduction to this phase of biochemistry.

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**Substances Naturelles de Synthèse.** Volume X. By LÉON VELLUZ, Docteur des Sciences Physiques. Masson et Cie, Éditeurs, 120 Boulevard Saint-Germain, Paris VI, France. 1954. 200 pp.  $16 \times 22.5$  cm. Price, Broché 2300 fr.; Cartonné toile 2700 fr.

This book presents easily followed directions for the preparation of eight naturally occurring organic substances, such as D-glucosamine, listed in the index at the front,

though one preparation is out of sequence. In addition, there are two sections devoted to methods—peptization and the synthesis of isoprene chains. A third portion is devoted to intermediates in peptization.

There are, in addition, useful addenda to the preparations. For example, in the section covering the synthesis of  $\beta$ -carotene the general introduction leads, followed by the laboratory directions proper, then under "Notes" are "Other Syntheses," "Stereochemistry," "Other Carotenoids" and "Absorption Spectra."

Modern spectroscopic methods also are discussed.

There is an index which covers preceding volumes of this series.

This is the sort of publication which should appeal to specialists and should be of considerable value to them and even to others, in providing workable laboratory directions for the preparation of certain compounds as well as a factual background for each.

The preparations include DL-arginine, Vitamin A, L-carnosine,  $\beta$ -carotene, ergothionine, D-glucosamine, DL-penicillamine and retinene.

DEPARTMENT OF CHEMISTRY  
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**Emulsion Polymerization. High Polymers. Vol. IX.** By FRANK A. BOVEY, Minnesota Mining and Manufacturing Co., I. M. KOLTHOFF, University of Minnesota, AVROM I. MEDALIA, Boston University, and EDWARD J. MEEHAN, University of Minnesota. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, New York. 1955. xii + 445 pp. 16 × 23.5 cm. Price, \$12.50.

The authors have done a magnificent job of assembling and correlating the tremendous volume of investigative work carried out during the war years and immediately thereafter, largely under the aegis of the Office of Rubber Reserve. The book deals almost exclusively with the kinetics and mechanism of emulsion polymerizations, particularly styrene-butadiene (GR-S) systems, rather than with physical properties of the end products.

A striking feature of the topic organization is the excellent summarizing of the general features of each aspect of the polymerization process involving free radicals, which precedes discussion of that aspect applied to the particular case of emulsion polymerization. Taken together, these summaries comprise nearly 20% of the volume. After 58 pages of general summary, separate treatment is given to initiating systems, chain transfer agents, the role of the detergent, the over-all kinetics of the process, inhibition and retardation, and copolymerization. Literature coverage appears not to extend much beyond 1952. The authors make a valuable contribution in pointing out existing contradictions and in many cases suggest further research so specifically that the reader wonders whether at least some of the points may not by now in 1955 be at least partially resolved. Chapters IX, X and XI, dealing with experimental techniques and with aspects of the practical formulation of recipes appear to be extremely useful.

Soap chemists have been inclined to accuse polymer chemists of playing fast and loose with their description of the nature of micelles. Possibly the real blame lies with the soap chemists themselves for not yet being able to present a fully self-consistent picture. Nevertheless both schematic micelles on p. 150 are largely outmoded. It must be admitted that the circumstance in no way affects the major conclusions on the role of detergent in emulsion polymerization.

The book is profusely illustrated with graphical data. Often, however, the legends are not fully adequate to indicate what conclusion results from them and the reader must hunt a while in the text for explanation. Also in many instances symbols for different types of points are almost indistinguishable. Apart from this feature the physical format of the book is good. Author and subject indexes are excellent.

Like its predecessors in the high polymer series this book will find its way to the working libraries of virtually every active polymer chemist and many others who wish to keep abreast of this important field.

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## BOOKS RECEIVED

August 10, 1955–September 10, 1955

E. A. BRAUDE AND F. C. NACHOD (Editors). "Determination of Organic Structures by Physical Methods." Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. 810 pp. \$15.00.

PAUL H. EMMETT (edited by). "Catalysis." Volume III. "Hydrogenation and Dehydrogenation." Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1955. 504 pp. \$12.00.

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D. A. FRANK-KAMENETSKII. "Diffusion and Heat Exchange in Chemical Kinetics." Translated by N. Thou. Princeton University Press, Princeton, New Jersey. 1955. 370 pp. \$6.00.

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H. H. HATT, T. PEARCEY, AND A. Z. SZUMER. "Anti-Composition Tables for Carbon Compounds (CH, CHO, CHS, and CHOS)." Cambridge University Press (American Branch), 32 East 57th Street, New York 22, N. Y. 1955. 191 pp. \$4.00.

FRIEDRICH HECHT AND MICHAEL K. ZACHERL (Editors). "Handbuch der Mikrochemischen Methoden." Volume II. "Verwendung der Radioaktivität in der Mikrochemie." "Radiochemische Methoden der Mikrochemie." By E. Broda and T. Schönfeld. "Messung Radioaktiver Strahlen in der Mikrochemie." By T. Bernert, B. Karlik, and K. Lintner. "Photographische Methoden in der Radiochemie." By H. Landa. Springer-Verlag, Mölkerbastei 5, Wien 1, Austria. 1955. 423 pp. \$19.30; Subscribers to Handbuch, \$15.45.

W. KÖSTER (Editor). "Reine und Angewandte Metallkunde in Einzeldarstellungen." Volume 3. "Diffusion in Metallen. Platzwechselreaktionen." Second Edition. By Wolfgang Seith and Theodor Heumann. Springer-Verlag, Reichpietschufer 20, Berlin W 35 (West-Berlin), Germany. 1955. 306 pp. Ganzleinen geb. DM 39.-.

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K. C. LI AND CHUNG YU WANG. "Tungsten. Its History, Geology, Ore-Dressing, Metallurgy, Chemistry, Analysis, Applications, and Economics." American Chemical Society Monograph. Third Edition. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1955. 506 pp. \$14.00.

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W. W. WESTERFELD (Editor-in-Chief). "Biochemical Preparations." Volume 4. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. 108 pp. \$3.75.