

antipneumococcal horse serum.² Dialysates of such heated preparations contained most of the methylpentose and a portion of the non-hexosamine nitrogen of the blood group substances.² Much of this dialyzable non-hexosamine nitrogen is now found to consist of six free amino acids, aspartic acid, glutamic acid, lysine, serine, threonine and glycine. These were identified and the amounts liberated determined quantitatively by treatment of the dialysate with dinitrofluorobenzene, extraction of dinitrophenyl (DNP) derivatives with ether and chromatographic separation and identification of the DNP derivatives on silica gel using combinations of the fractionation methods developed by Sanger^{3,4} and Blackburn.⁵ Further identification of the various amino acids was provided by filter paper chromatography of their DNP derivatives. Although slight differences in pH greatly affect the total amounts of the amino acids liberated from one preparation to another, aspartic acid is always found in largest amount, followed generally in the order given by lysine, glycine, serine, threonine and glutamic acid. On a mole basis, the aspartic acid liberated approximates the sum of the other free

(2) E. A. Kabat, H. Baer, A. E. Bezer and V. Knaub, *J. Exp. Med.*, **88**, 43 (1948).

(3) F. Sanger, *Biochem. J.*, **39**, 507 (1945).

(4) R. R. Porter and F. Sanger, *ibid.*, **42**, 287 (1948).

(5) S. Blackburn, *ibid.*, **45**, 579 (1949).

amino acids. An interpretation for the present findings is provided by the report by Partridge⁶ and by Blackburn⁷ that peptide bonds joining aspartic acid and asparagine to other amino acids in insulin and in wool are labile and are preferentially split by mild acid hydrolysis with the liberation from these proteins of free aspartic acid. That five other amino acids are liberated from the blood group substances as well and that aspartic acid is present in largest amount suggests that a portion of the blood group molecule consists of one or more peptide chains with aspartic acid in alternate positions, the remaining positions being occupied by the other five amino acids. Such a unique structural pattern composed largely of polar amino acids with alternate aspartyl or asparaginy residues could account for the resistance of the polypeptid chain of the blood group substances to the proteolytic enzymes and may be important in determining the specificity and blood group activity of these substances.

(6) S. M. Partridge and H. F. Davis, *Nature*, **165**, 62 (1950).

(7) S. Blackburn, *Biochem. J.*, **47**, xxviii (1950).

DEPARTMENTS OF BACTERIOLOGY AND NEUROLOGY
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RECEIVED APRIL 16, 1951

BOOK REVIEWS

Structural Chemistry of Inorganic Compounds. Volume I. By WALTER HÜCKEL, Dr. Phil., Professor of Pharmaceutical Chemistry, Tübingen University, formerly Professor of Organic Chemistry in the University and Technische Hochschule of Breslau. Translated by L. H. LONG, B.Sc., Ph.D. (London), Ph.D. (Cantab.), A.R.C.S., D.I.C., Lecturer in the Department of Chemistry, University College, Exeter. Elsevier Publishing Company, Inc., 250 Fifth Avenue, New York 1, N. Y., 1950. xii + 437 pp. 18 × 26 cm. Price, \$9.00.

The present volume is a translation of the first half of a book published in Germany in 1948. The second and concluding volume of the translation is promised by the publisher for the summer of 1951. Most of the book was written during World War II and so the literature from 1940 on was not all available to the author. (This is evident for example in the critical discussion of "mesomerism" (resonance) as applied to the additivity rule for interatomic distances, pp. 431-434, which should be modified in the light of the important contribution of Schomaker and Stevenson (1941). The discussion of MoCl₂ does not include Brosset's solution of this structural problem (1945, 1947).)

The author's object is "to furnish inorganic chemistry with . . . a structural and constitutional theory in one embracing representation." He classifies substances not by the position of their elementary constituents in the periodic table but by the kinds of chemical bonds that occur in the substances. Volume I contains a long (and, in the reviewer's opinion, dull and unnecessary) introductory discussion of some epistemological problems in chemistry. This is followed by a treatment of coordination compounds, including considerable advanced, interesting descriptive material. The discussion of polymuclear complexes includes the iso-

poly- and heteropoly-acids, metaphosphates and silicic acid. Some of these difficult and complicated fields have been studied intensively by German chemists, and non-specialist, English speaking readers will appreciate the present introduction to these topics.

The periodic system, atomic structure and spectra, etc., are then presented. Why this section includes such subjects as isotope separation, nuclear physics, and ortho- and para-hydrogen is not evident. Methods for investigating the nature of chemical bonds are then treated. The volume concludes with a discussion of chemical binding, using the united atom, molecular orbital point of view. Volume II will be mainly concerned with the structure and constitution of inorganic compounds, and will contain more descriptive material.

The following paragraph summarizes the reviewer's opinion of this book. It is not recommended to any class of readers. The selection and ordering of topics is not appropriate for the stated aim of the author. The effort to give an encyclopedic account of fundamental material has failed; too many topics are considered and, in many cases, the presentations are too long and not very good. The prose style is complicated and it is almost invariably difficult to discern the author's meaning. The chapter on coordination compounds is exempted from these criticisms.

The volume concludes with a note by the translator—an intemperate attack on the theory of resonance. This attack may have the good effect of stimulating (or irritating) theoretical chemists interested in resonance to explain more carefully the conditions required for resonance between several electronic structures.

GATES AND CRELLIN LABORATORIES OF CHEMISTRY
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NORMAN DAVIDSON

Fluorine Chemistry. Volume I. Edited by Dr. J. H. SIMONS, Fluorine Laboratories, The Pennsylvania State College, State College, Pennsylvania. Academic Press, Inc., Publishers, 125 East 23rd Street, New York, N. Y. 1950. xvii + 615 pp. 16.5 × 23.5 cm. Price, \$12.00.

This treatise on "Fluorine Chemistry" is a co-authored compilation of sixteen chapters. There are many facets to this field of chemistry and the authors give excellent up-to-date reviews of some of the areas. The book is highly recommended and especially for those interested in inorganic fluorides.

The inorganic fluorides have been arbitrarily divided into volatile and non-volatile compounds. Very complete reviews of the literature on these substances are given. The discussion of methods of preparation and chemical properties is especially well done. Also, the preparation and properties of the fluoro acids of fourth, fifth and sixth group elements are covered rather completely and in an excellent manner. The uses of fluorine compounds in glass technology and ceramics are described. Special treatment is given to boron trifluoride, hydrogen fluoride and the halogen fluorides. The catalytic properties of the first two are discussed in considerable detail.

One entire chapter is given to the theoretical aspect of fluorine chemistry. This excellent discussion is particularly complete with respect to fluorine and hydrogen fluoride. Numerous investigators have treated organic compounds with elementary fluorine with varying degrees of success. The mechanisms for these reactions are presented and many compounds are given which have been prepared by this method. The methods for the preparation of aliphatic chlorofluoro compounds are reviewed and an excellent table of these compounds is given showing their physical properties.

The most salient feature of the discussion on fluorocarbons and so-called fluorocarbon derivatives is the unique system of nomenclature. This may confuse readers who are not skilled in the chemistry of organic fluoro compounds. This system of nomenclature has been considered by nomenclature committees of the American Chemical Society and rejected. A good analysis of the preparation of fluorocarbons is given.

DEPARTMENT OF CHEMISTRY
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E. T. MCBEE

Notions Moderns sur L'Atome et La Valence. By A.

TRAVERS, Ancien élève de l'École Normale Supérieure, Professeur honoraire aux Facultés des Sciences de Nancy et de Lyon, Directeur honoraire de l'École Supérieure des Industries Chimiques de Nancy. Librairie Vuibert, Boulevard Saint-Germain, 63, Paris 5, France. 1950. ix + 208 pp. 16 × 24 cm. Price, 800 fr.

Professor Travers stated in the preface to this little book that he had written it as an introduction to the modern electronic theory of the atom and of valence, for the use of chemists and engineers. The book begins with a brief survey of quantum theory (essentially nonmathematical) and the electronic structure of atoms and molecules, and continues with the discussion of valence and the periodic system of the elements, magnetic properties, interatomic distances, resonance in aromatic and conjugated systems, the hydrogen bond, the metallic bond and the structure of atomic nuclei. The treatment throughout is simple, clear, and straightforward.

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LINUS PAULING

The Biochemistry of B Vitamins. American Chemical Society Monograph No. 110. By ROGER J. WILLIAMS, ROBERT E. EAKIN, ERNEST BEERSTECHE, JR., and WILLIAM SHIVE, University of Texas, Austin, Texas. Reinhold Publishing Corporation, 330 West Forty-second Street, New York 18, N. Y. 1950. x + 741 pp. 16.5 × 23.5 cm. Price, \$10.00.

This book constitutes a review of a rapidly expanding field of what was originally regarded as the vitamin B com-

plex. It consists of 741 pages divided into four sections, each written by one of the four authors.

Section A deals with the characterization, distribution, assay and biogenesis of the B vitamins. Section B takes up their catalytic functions. Section C discusses the role of the B vitamins in animal and plant organisms, and Section D deals with the comparative biological activities of the B vitamins and related compounds.

This cross sectional treatment of a certain function of all the vitamins in a single chapter is markedly different from the conventional practice of grouping all aspects of a single vitamin into one chapter. This arrangement by function is ideal in the discussion of the coenzymes derived from the B vitamins because several vitamin-containing coenzymes may be involved in a single chain of biochemical reactions. From the standpoint of the student or the teacher, considering one vitamin at a time, this arrangement makes it difficult to assemble information on this one subject.

This arrangement by function rather than by vitamin has necessarily resulted in some duplication. Such overlapping can perhaps be justified on the grounds that it is better to err in the direction of presenting the complete picture twice than piecemeal once.

The authors have endeavored to make their book very complete. A total of 21,360 literature citations are made although some of these obviously are repeated in the different sections. The reader will find a tremendous amount of material compiled although perhaps at the price of occasional lack of critical evaluation. As an example, in the chapter on the B vitamin requirements of animals the requirements of inositol, pyridoxine and biotin for man and other species are plotted as function of total body weight. Actually no data are available on the known requirements for these vitamins for man. It is apparent that the recommended allowances used in another part of the book and which were determined by food analysis and comparison with other species have been incorporated into a graph which represents them as experimentally determined requirements.

The section on catalytic functions of the B vitamins is an excellent presentation of the enzyme systems in which vitamins or their derivatives function as coenzymes. The section on comparative biological activities of the B vitamins and related compounds contains a discussion of the application of technique of "inhibition analysis to the study of vitamin antagonists." Many of the recent contributions to our knowledge of B vitamins have been in the field of vitamin antagonists and this comprehensive and orderly presentation is most welcome.

This book will form a very useful addition to the library of those working in the field. Certain sections, especially that on "Catalytic Functions of the B Vitamins" are must reading for the student of biochemistry. The book, considered in its entirety, fills a place not occupied by any other at the present time.

LEDERLE LABORATORIES DIVISION
AMERICAN CYANAMID COMPANY
PEARL RIVER, NEW YORK

E. L. R. STOKSTAD

Carotenoids. By PAUL KARRER, Director of the Chemical Institute of the University of Zürich, and ERNST JUCKER, Research Assistant at the Chemical Institute of the University of Zürich. Translated and revised by ERNEST A. BRAUDE, Lecturer in Organic Chemistry, Imperial College of Science and Technology, London. Elsevier Publishing Company, Inc., 250 Fifth Avenue, New York 1, N. Y. 1950. x + 384 pp. 17 × 24.5 cm. Price, \$8.50.

The scientific monograph written by experts provides one of the best means for following progress in specialized fields and for providing correlated information to fresh workers. It is particularly gratifying, therefore, that Professor Karrer and Dr. Jucker, long recognized for their productive research, have prepared this extensive monograph concerning the occurrence, the properties and the chemistry of the carotenoids. It is equally satisfying to find that the prospective demand for this book has stimulated its translation into English by Dr. E. A. Braude of the Imperial College of Science and Technology.

Written first in German and published in Switzerland,

and now translated into English and printed in The Netherlands, this book is distributed by agents throughout the British Commonwealth, Canada, India, the United States, Belgium and The Netherlands. Its production under these circumstances is a striking reversal of the current trend toward the centralization of research activities and the control of results in the interest of corporate and national endeavor.

In form as well as in substance, the English translation by Dr. Braude follows closely the German edition, which was reviewed two years ago [THIS JOURNAL, 71, 759 (1949)]. The page size is identical and formulas, figures and colored plates have been reproduced without change. Page numbers differ slightly from the original due to use of Roman numerals for the introductory pages and due to the transference of footnote references to tables that follow each chapter. The page numbers for these tabulated chapter references have been repeated conveniently at the bottom of each page.

References to carotenoids from various sources, as diatoms and yeast, have been added to the translation, but the nature of the pigments obtained from these sources has not been indicated. Inclusion of references to the numerous spectral absorption curves of the carotenoids would have improved the usefulness of the book, particularly for exploratory work. Indeed, spectral absorption properties, relative solubilities, and adsorption sequences in Tswett columns usually serve for the comparison of pigments from various sources long before the molecular structures are determined. In the hands of skilled investigators, these comparisons have become an art that is not readily acquired from the chemical literature.

The carotenoids have long been recognized as physiologically important substances. They serve as photoreceptors in vision, as precursors of vitamins, as the natural coloring matter in many organisms, and as indispensable components of the photosynthetic apparatus of green plants. By making information about these reactive polyene compounds more readily available to the English-speaking investigators, Dr. Braude has not only contributed to the dissemination of knowledge in this field, but he will also have stimulated advance in many areas of scientific endeavor, including chemistry, biology, physiology, nutrition and medicine. By this correlation and dissemination of the diversified work of numerous investigators, he has promoted the common effort of scientists to improve man's lot in the world.

ARGONNE NATIONAL LABORATORY HAROLD H. STRAIN
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Colorimetric Determination of Traces of Metals. Chemical Analysis. Volume 3. Second Edition, Revised and Enlarged. By E. B. SANDELL, Professor of Analytical Chemistry, University of Minnesota, Minneapolis, Minnesota. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1950. xix + 673 pp. 16 × 23.5 cm. Price, \$9.00.

The first appearance of this book in 1944 served to emphasize the importance of colorimetric methods in the determination of trace quantities of metals. During the past six years considerable progress has been made in the improvement of existing methods and in their application to a wide variety of materials, but only a few new ones have been added. Studies have been made on the effect of foreign elements on a particular color reaction, to establish optimum conditions for a number of the more important colorimetric reagents, and to elucidate the relationships between the molecular structures of organic compounds and their reactivity with inorganic ions, thus establishing "guideposts" to serve in the search for new useful color reactions, ones that are highly sensitive, specific or selective, and possess good reproducibility and stability of color.

This interest in colorimetric analysis has resulted in the publication of hundreds of papers in recent years and has made necessary revision and extensive additions to Dr. Sandell's book. A few of the older procedures have been eliminated but "the objectives and plan of the book remain the same."

The book is arranged in two parts, the first (Chapters 1-4) deals with the general aspects of colorimetric trace analysis (135 pages, an increase of 27 pages); the second (Chapters 5-49) is devoted to procedures (504 pages, an increase of 151 pages), the chapters being arranged alphabetically according to the elements which include the following: Al, Sb, As, Ba, Be, Bi, Cd, Ca, Ce, Cr, Co, Cb(Nb), Ta, Cu, Ga, Ge, Au, In, Ir, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, Os, Pd, Pt, K, rare earths, Re, Rh, Ru, Sc, Ag, Na, Ti, Sn, Ti, W, U, V, Zn and Zr. In addition to a four-place log table, a transmission-extinction table and a table of atomic weights, the Appendix has a table of sensitivities of the color reactions (both visually and spectrophotometrically) for most of the methods described in the text. Author and subject indexes complete the volume.

This new edition presents an up-to-date, reliable and critical collection of methods that appear to be best suited for trace metal analysis. Usually a choice of several methods for each metal is given. There are numerous references to the original literature, conveniently placed at the bottom of the pages. Many useful tables (107) of data and illustrative figures (85) appear throughout the text. Paper, printing and binding are good.

Dr. Sandell's book will not only be useful to those who need to determine trace quantities of metals in a wide variety of materials but will also be welcomed by analytical chemists interested in developing new methods or improving and adapting old methods to specific problems.

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JOHN H. YOE

BOOKS RECEIVED

April 10, 1951-May 10, 1951

- ADRIEN ALBERT. "The Acridines. Their Preparation, Physical, Chemical and Biological Properties and Uses." Longmans, Green and Co., Inc., 55 Fifth Avenue, New York, N. Y. 1951. 381 pp. \$14.00.
- WILFRID J. DIXON AND FRANK J. MASSEY, JR. "An Introduction to Statistical Analysis." McGraw-Hill Book Company, 330 West 42nd Street, New York 18, N. Y. 1951. 370 pp. \$4.50.
- M. GUGGENHEIM. "Die biogenen Amine." 4th Edition. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. (S. Karger, Holbeinstrasse 22, Basle, Switzerland). 1951. 619 pp. Swiss francs 75.-
- O. KUBASCHEWSKI AND E. LL. EVANS. "Metallurgical Thermochemistry." Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1951. 368 pp. \$6.00.
- HENRY L. LANGHAAR. "Dimensional Analysis and Theory of Models." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1951. 166 pp. \$4.00.
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- C. M. SUTER (Editor-in-Chief). "Medicinal Chemistry." Volume I. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1951. 473 pp. \$10.00.
- ERNEST E. WAHLSTROM. "Optical Crystallography." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1951. 247 pp. \$4.50.
- EGON WIBERG. "Anorganische Chemie." Walter De Gruyter and Co., Genthiner Strasse 13, Berlin W 35, Germany. 1951. 634 pp. DM 24, Ganzln.
- R. T. WILLIAMS (organized and edited by). "The Biochemistry of Fish." Biochemical Society Symposia No. 6. Cambridge University Press (American Branch), 51 Madison Avenue, New York 10, N. Y. 1951. 105 pp. \$2.75.