

on synthesis of inorganic compounds, F. P. Dwyer surveys the methods and principles of synthesis of a number of inert chromium(III) and cobalt(III) compounds. The lecture on structure and stereochemistry by R. J. Gillespie is a review of the Sidgwick-Powell and Gillespie-Nyholm concept of the "best" arrangement of electron pairs about a central ion. This concept has been extended to coordination numbers 7, 8 and 9 with a number of specific examples. G. Wilkinson discusses metal-hydrogen bonds, pointing out that a number of supposed low-oxidation state metal complexes are more likely hydride complexes of higher oxidation state metals. Also discussed are a number of  $\pi$ -bonded hydrocarbon-metal derivatives. In a lecture on the bio-chemical significance of coordination compounds, R. J. P. Williams discusses, in particular, the role of molybdenum and cobalt in biological systems. H. Zeiss discusses the role of several metal "sandwich" compounds as intermediates in the reaction of phenyl Grignard reagent to give biphenyl. Finally, K. B. Yatsimirski reviews the methods of measurement of stability constants and discusses the significance and origin of the enthalpy and entropy terms. Of particular interest here, is the application of metal ion catalysis of reactions to the determination of stability constants of complexes of the metals, which, in the opinion of the author, is one of the more promising of the new stability constant methods.

The papers cover this same broad range of interest but each, of course, is of less general interest. The reader seeking detail may, in some cases, not be satisfied. While many of the papers are detailed and complete, others are merely abstracts, while others are either short or long reviews. Most are well referenced and, while some of the results may only be preliminary, the greatest value of the collection is that it serves as a spot-survey of the voluminous research being done in inorganic chemistry.

DEPARTMENT OF CHEMISTRY  
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BERNARD R. BAKER

**Phosphorus and its Compounds. Volume II. Technology, Biological Functions and Applications.** Edited by JOHN R. VAN WAZER, Senior Scientist, Monsanto Chemical Company, St. Louis, Missouri. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N.Y. 1961. xvi + 1092 pp. 16 × 23.5 cm. Price, \$35.00.

The second volume of the set describing the technology and the various applications of phosphorus appears some three years after the first volume of this useful publication.

The author dedicates this volume to "the salesman of phosphorus products..." although in my opinion the material covered in this book covers much more ground than might be indicated by such a dedication. The nineteen chapters of this volume are grouped as to general areas of: technology (six chapters, dealing with occurrence and mining, utilization and economics, wet-process phosphoric acid, fertilizer manufacture, manufacture of elemental phosphorus and major inorganic compounds, and manufacture of phosphate esters and organic phosphorus compounds), biological functions (three chapters dealing with phosphates in life processes, phosphates in biological macromolecular synthesis and energy mechanisms, and mineralized tissues) and applications (ten chapters, dealing with plant nutrition and utilization of fertilizer phosphorus, animal nutrition and phosphates in feeds, food and dentifrice applications, action of phosphates on finely divided solids, detergent building, hard-surface cleaning and water treatment, phosphorus in metallurgy, surface treatment of metals, uses of organic phosphorus compounds, and miscellaneous applications). Four appendices listing patents on phosphates in their principal applications are provided, along with an index of some 32 pages.

Unlike the first volume of this set, which was written quite evenly and with an evidently single purpose, the present volume covers such a diversity of subjects, some of which are not chemical by their nature, that a uniform mode of presentation is not achieved, even if such were possible.

As might have been expected, the bulk of material contained in this well manufactured volume discusses in considerable detail the aspects of phosphorus as a component of various articles of commerce. The large scale uses of the element and its compounds are given the lion's share of the

book and appropriate citations of economic facts support this treatment quite adequately. The manufacturing aspects of inorganic phosphates are dealt with in considerable detail and should prove useful to the many persons engaged in phosphate business. Both chemical and engineering data are provided for the reader in convenient form and in very readable language. The readers with the more scientific bent of mind will find an excellent summary of information on the action of phosphorus compounds in systems with large surfaces and small particles, *i.e.*, the fields in which enormous amounts of phosphates are used all over the world.

On the other hand, readers interested in the role of phosphorus in biochemistry may well be disappointed by the small share of this volume devoted to this general topic. This fact was undoubtedly generated by the tone of the volume indicated by the dedication. This section does provide a reader with the general picture of the metabolic role of the element, but in a field moving so rapidly in the past decade, one cannot expect such a treatment to be completely up-to-date or exhaustive within the allowed space. It may be added that the statement appearing on p. 1389 may well be argued by physical chemists ("...free energies merely represent a fancy way of reporting equilibrium constants"). Treatment of the applications of organic compounds of phosphorus also appears to be rather skimpy; probably, for the same reason.

In other words, this volume is addressed primarily to the inorganic chemist (or salesman).

Some application topics which are growing extremely rapidly and (hopefully) profitably seem to have received unduly short discussions. These are the oil additives and functional fluids, especially the latter. As indicated by the author, the latter formulations are proprietaries whose formulations are jealously guarded by the manufacturers. This is made very clear to the reader of such sections in which Trade Names only are used and the chemist is left out in the cold. In other words, a person not in the business would not even know what compounds are under discussion. While reticence in matters of business and economics is quite understandable, material of this nature does not appear to be particularly useful to a "lay" reader or even to a practicing chemist.

On the whole the volume is a fair presentation of the practical aspect of phosphorus chemistry. A pure scientist will not find very much material to digest from it, except for the few sections mentioned. A practical man will find vast amounts of useful information and all the charts and diagrams that his heart could desire.

The book is well made, even at its price, and the illustrations are generally good and to the point. One useful feature of the volume is the seven page insert of errata found in the first volume of this set. It is to be hoped that the second volume will have a much shorter list of errata (this is borne out by my examination).

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G. M. KOSOLAPOFF

**The Pfizer Handbook of Microbial Metabolites.** By MAX W. MILLER, Ph.D., Pfizer Medical Research Laboratories, Chas. Pfizer and Co., Inc. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1961. x + 772 pp. 16.5 × 23.5 cm. Price, \$15.00.

This volume is a comprehensive listing of the compounds produced by microorganisms from carbohydrates. The latest proposed or accepted structures are given. Some useful properties and at least one pertinent reference to each compound are given. The substances are arranged, as far as possible, in chapters of chemically related compounds.

Most chapters have an introduction summarizing the literature pertinent to the group in the chapter, "emphasizing occurrence and biosynthetic background."

Three appendices on the chemical composition of various bacteria and fungi are included. There is an Addendum (not indexed) of recent material bringing the information up to 1961. The volume is indexed by microorganism and subject.

This is an excellent book in concept and organization. The typography and design are also sound. For many years this should be a standard reference work which will demand the publication of supplements or an occasional revision. There is no doubt that this is a monumental handbook. It gathers into one volume the present information about these metabolites from fungi, actinomycetes and bacteria, including, necessarily, the antibiotics. Previously this material was disseminated through reviews, texts, short monographs and the original papers.

The references by intent are not exhaustive, but a good selection of pertinent references has been made. The chapter on General References extensively supplements the particular references with reviews, books and papers.

It would be unbelievable if a work of this extent had no errors nor omissions. As the prerogative of a review a few corrections may be pointed out. Byssochlamic acid, a product from *Byssochlamys fulva*, isolated by H. Raistrick and G. Smith (*Biochem. J.*, 27, 1814 [1933]), could not be found although other compounds of similar indefinite structure are included. On page 68, in the first reference under spiculisporic acid, the name should be Rintoul, not Pintoul.

The Addendum contains a large amount of valuable material, but loses much of its usefulness since there is no index. Much of the material is presented as a flow of, sometimes disconnected, sentences and notes. This makes the chapter a veritable wastebasket of notes. It should have been well if this Addendum had more clearly followed the style of the other chapters.

In spite of these minor complaints, the reviewer feels that this is a publication of great value to the chemist and microbiologist. The price is moderate in light of the extensive and, generally, well organized information contained.

Dr. Miller and The Pfizer Company are to be complimented.

BIOCHEMISTRY RESEARCH  
THE UPJOHN COMPANY  
KALAMAZOO, MICHIGAN

HERBERT C. MURRAY

**Combustion, Flames and Explosions of Gases.** Second Edition. By BERNARD LEWIS, Ph.D., Sc.D. (Cantab.) and GUENTHER VON ELBE, Ph.D. (Berlin), Combustion and Explosives Research, Inc., Pittsburgh, Pennsylvania. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xix + 731 pp. 16 × 23.5 cm. Price, \$22.00.

Lewis and von Elbe are the grand-daddies of combustion research. Their pre-World War II research and their 1938 treatise (Cambridge Press, same title) served as the basis for most of our present experimental and theoretical efforts. From the very beginning, Lewis and von Elbe recognized the importance of thermodynamics and reaction kinetics in interpreting flame phenomena. Thus, any book written by these eminent authors is bound to command the interest of all serious workers in the combustion field.

However, the new Second Edition is really very similar to the First Edition. The additions and changes appear to be very minor, although there have been great advances in the fields of combustion and detonations since the First Edition was published in 1951. This book describes a great variety of flame and explosion phenomena and tries to explain them in a semi-quantitative fashion. The modern highly mathematical theories of flames and detonations are ignored.

The treatment of detonations is very incomplete and omits any mention of the brilliant post-war research at Los Alamos. And, quite excusably, it omits the very recent work of Donald White (*Phys. Fluids*, 4, 465 (1961)) which probably was not available to the authors before the Second Edition went to press. White demonstrated experimentally that the reaction zone in a gaseous detonation is frequently not laminar. This work has subsequently been confirmed by other workers and has led to considerable changes in our notions regarding the structure of gaseous detonations.

The first 200 pages of the Second Edition are devoted to the chemical kinetics of reactions between gaseous fuels and oxidants. The complexity of the various chain reactions required to explain the experimental combustion limits and flame phenomena is most impressive. It is surprising that the key free-radical in the combustion process, HO<sub>2</sub>, has never been observed spectroscopically and its mass spectro-

scopic identification is not yet positive. The theoretical prediction and the experimental verification of the properties of HO<sub>2</sub> is currently a very important research problem.

The rest of the book is devoted to combustion phenomena. The authors are to be complimented on describing and discussing the scientific problems without getting entangled in the myriads of engineering detail. As the title indicates, the treatise is limited to gaseous phenomena and no mention is made of solid propellants.

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JOSEPH O. HIRSCHFELDER

**Physical Methods in Chemical Analysis. Volume IV.**

Edited by WALTER G. BERL, Applied Physics Laboratory, Johns Hopkins University, Silver Spring, Maryland. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xi + 476 pp. 16 + 23.5 cm. Price, \$16.00.

This volume deals exclusively with separation methods based on the use of dialysis (38 pp.), molecular sieves (50 pp.), foams (17 pp.), electromagnetic properties (92 pp.), ion exchange (84 pp.), inclusion compounds (39 pp.), thermal diffusion (45 pp.) and solvent extraction (136 pp.). The general outline followed by each author in writing his chapter was a review of the theory and derivation of equations, practical aspects of the technique together with a presentation of applications in analytical chemistry and a bibliography of the more recent literature. The first chapter and the last four each have extensive bibliographies. The last chapter includes much useful data in 23 tables.

DEPARTMENT OF CHEMISTRY

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THOS. DE VRIES

**Carbon-14 Compounds.** By JOHN R. CATCH, The Radiochemical Centre, Amersham, Bucks., England. Butterworth Inc., 7235 Wisconsin Avenue, Washington 14, D.C. 1961. vii + 128 pp. 14 × 22 cm. Price, \$5.50.

The scope of this book is not apparent from the title; quoting the author this book is "not a practical text book" nor is it a "comprehensive index" or description of carbon-14 preparations. Rather is it a philosophical treatment of the entire field of carbon-14 chemistry. The book is intended for the newcomer to help him benefit from the experience of those who have preceded him.

The book is divided into 8 chapters: (1) Introduction, (2) Production of Carbon-14, (3) Chemical Synthesis, (4) Biological Methods of Labeling, (5) Peculiar Features of Carbon-14 Compounds, (6) Analysis, (7) Measurement of Carbon-14, (8) Precautions in the Use of Carbon-14 Compounds.

In the introduction the author lists the books and bibliographies in the field. The chapter is replete with kindly advice and warns against some common errors in research with radioactive isotopes. Chapter 2 is of academic interest only and outlines the reactions used for the production of carbon-14. His remarks concerning "recoil labeling" and the difficulty of purification of highly impure complex compounds are timely. The difficulties encountered in the preparation of complex organic compounds starting from carbonate-C-14 are covered in chapter 3. The principles governing the selection of a synthesis, the use of "carriers," explanation of elementary procedures and equipment (which differs somewhat from American practice) are all covered in this chapter, which is one of the best in the book. The chapter covering biological labeling, chapter 4, is a "must" for anyone entering this field of research. The author has given an excellent review of the methods and organisms used to prepare compounds through biologic labeling. The reviewer was surprised at the efficiency with which some organisms can incorporate carbon-14 into complex organic compounds. This is not true of most of the organisms studied and clearly shows this to be a fertile field for research. The difficulties and disadvantages of the method are clearly explained.

Isotope effect, auto-radiation, isomerism and nomenclature are well covered in chapter 5.