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
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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_2, has never been observed spectroscopically and its mass spectroscopic identification is not yet positive. The theoretical prediction and the experimental verification of the properties of HO_2 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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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.

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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.

Chemical purity and radiochemical purity, and the tests using isotope dilution, radio-autograph and gas–liquid chromatography are covered in chapter 6. The discussions of "isotope dilution" analysis and paper chromatography of labeled compounds are excellent. The review of counting methods and procedures covered in chapter 7 is complete and thorough and covers the standard procedures in common use. The author assumes a greater knowledge than is possessed by the average person reading this chapter. The theory of the flow counter is not explained nor is the "proportional region" defined. Under the discussion of "standards" the author neglects to warn that radioactive plastics do not always give the same count on both sides of the film.

A sensible explanation of the precautions and safeguards necessary when working with radioactive materials is given. The methods for disposal of wastes and allowable contamination differ little from American practice. The reasonable attitude of the author toward handling modest amounts of carbon-14 should do much toward allaying fears of the beginner in this field of chemistry.

The book is recommended to all contemplating entering this field of research.

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Metabolic Pathways in Microorganisms. E. R. Squibb Lectures on Chemistry of Microbial Products, Presented at the Institute of Microbiology, Rutgers, The State University of New Jersey. By VERNON H. CHELDELIN, Director, Science Research Institute, Oregon State University. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. ix + 91 pp. 13 × 19 cm. Price, $3.50.

In the first two lectures Cheldelin reviews the extensive work he and his associates have carried out on the different metabolic pathways of *Acetobacter suboxidans*. This aerobic organism is unique, even among closely related species of *Acetobacter*, in being unable to carry on oxidations by way of the citric acid cycle. Of the intermediates of the cycle, citric acid is the only one which is weakly oxidized. Oxalacetate yields pyruvate and acetate. This raises the question (as yet unanswered) of the origin of amino acids which normally arise from the cycle, especially glutamate and aspartate.

Quantitative data on $C^{14}O_2$ arising from the oxidation of glucose or gluconate labeled in the C-1, C-2, C-3, C-4 and C-6 position indicate that the pentose cycle is the terminal oxidation route in this organism and that virtually all the CO_2 formed from glucose arises in this manner. There is no indication that glycolysis is operative in the intact organism. When cell-free extracts are treated with Dowex-50 to remove magnesium ions and coenzymes, it becomes possible to demonstrate some of the glycolytic reactions with fructose diphosphate as substrate. In the presence of magnesium ions the pentose cycle is favored to the virtual exclusion of glycolysis.

Most of the enzymes of the pentose cycle and some ancillary enzymes were identified in cell-free extracts of the organism and several of these enzymes were purified. There are also a number of particle-bound dehydrogenases present which oxidize individual polyhydroxy compounds such as mannitol and sorbitol to the extent of one atom of oxygen per molecule of substrate. A soluble dehydrogenase oxidizes either end of the sorbitol molecule depending on which pyridine nucleotide (TPN or DPN) is present.

The biochemical literature is replete with discussions of the validity of "traffic counts" by means of specifically labeled compounds, an indication that there is dissatisfaction with many of the methods so far developed. When more than one pathway is operative in the same organism, as is usually the case, data based on specific activity of CO_2 or of intermediary products have limited quantitative significance. These problems are discussed and it is pointed out that certain advantages arise when the yields rather than the specific activity of $C^{14}O_2$ from various metabolites are measured. This radiorespirometric method, as developed in the author's laboratory, is illustrated by showing the time course of CO_2 yields from specifically labeled substrates by various organisms. In a summarizing Table estimates are given for various microörganisms of the extent of glucose catabolism by way of glycolysis–Krebs cycle, pentose cycle and Entner–Doudoroff pathways.

The third lecture is devoted to general considerations of metabolic pathways of carbohydrate. The role of the pentose cycle in supplying TPNH for synthetic reactions is stressed. Some stimulating ideas are to be found in this well-written booklet which is dedicated to Roger J. Williams.

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States of Matter. By E. A. MOELWYN-HUGHES, Lecturer in Physical Chemistry, University of Cambridge. Oliver and Boyd, Tweeddale Court, Edinburgh 1, Scotland. 1961. 100 pp. 14.5 × 22.5 cm. Price, 15 s.

The eight chapters correspond to eight lectures on general theory and the seven states of matter: crystalline, gaseous, metallic, liquid, dissolved, ionic and interfacial. In the preface the author says that he has applied the concept of intermolecular force "as directly and in as simple a form as possible." Simplicity is attained by ignoring complicated cases and sweeping most of them under the rug. The book is most successful in the first four chapters where this is done ruthlessly and the discussion is limited almost entirely to monatomic elements and ions.

The last four chapters are less simple because these restrictions are generally removed, because the material is inherently more complicated, and also, it seems to me, because the author thinks much less clearly about those things which he learned as an undergraduate than about those which he picked up later by himself. I can see no excuse for developing the laws of ideal solutions the way Raoult did.

Much use is made of the "Mie equation" for the mutual energy, ϕ, of two molecules at a distance a cm. apart

$$\phi = Aa^{-n} - \mathrm{B}a^{-m}$$

"where A and B are positive constants and n and m integers with $n > m$."

The low point in the book is the discussion of the van der Waals "statical pressure" term in the last chapter. Confusion between a, the instantaneous distance between two molecules, and the average distance leads to the conclusion that the van der Waals term denotes $m = 3$ in the "Mie equation." In chapter III, however, equation 70 from the author's approximate treatment of the second virial coefficient corresponds exactly to the van der Waals equation. It shows that m may have any value *greater than* 3 and less than n (and not necessarily integral), which is the same result as that obtained by the rigorous treatment.

The high point for this reviewer is Table I in Chapter I, where the equilibrium distance and the energy of interaction at that distance of the pairs $Na^+–F^-$, $Na^+–OH_2$, $OH_2–OH_2$ and Ne–Ne are calculated from the known charges of the ions and dipole moment of water with the assumption that all have the same repulsion potential as neon with $n = 9$. It's crude but very good fun.

Moelwyn-Hughes continues the awarding of unusual credits for scientific advances. One erroneous one is a good example of how stories grow. He calls the relation $\ln \gamma = A\sqrt{c}$ Mellanby's law and refers to Cohn and Edsall, where I say (p. 27), "It is worth noting that the dependence upon the square of the valence and upon the square root of the concentration were both first discovered empirically by Mellanby in his study of the solubilities of globulins in salt solution." I misunderstood a statement that Mellanby's results could be expressed as $\log S/S_0 = A\sqrt{c}$ as saying that Mellanby had so expressed them, and I failed to check the original reference. Mellanby discussed neither log S nor $\sqrt{c}$. Moreover, his globulin was a mixture, so his solubilities are not directly related to the activity coefficient. My statement about the square of the valence, however, is correct and is not affected by the fact that Mellanby studied a mixture.

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